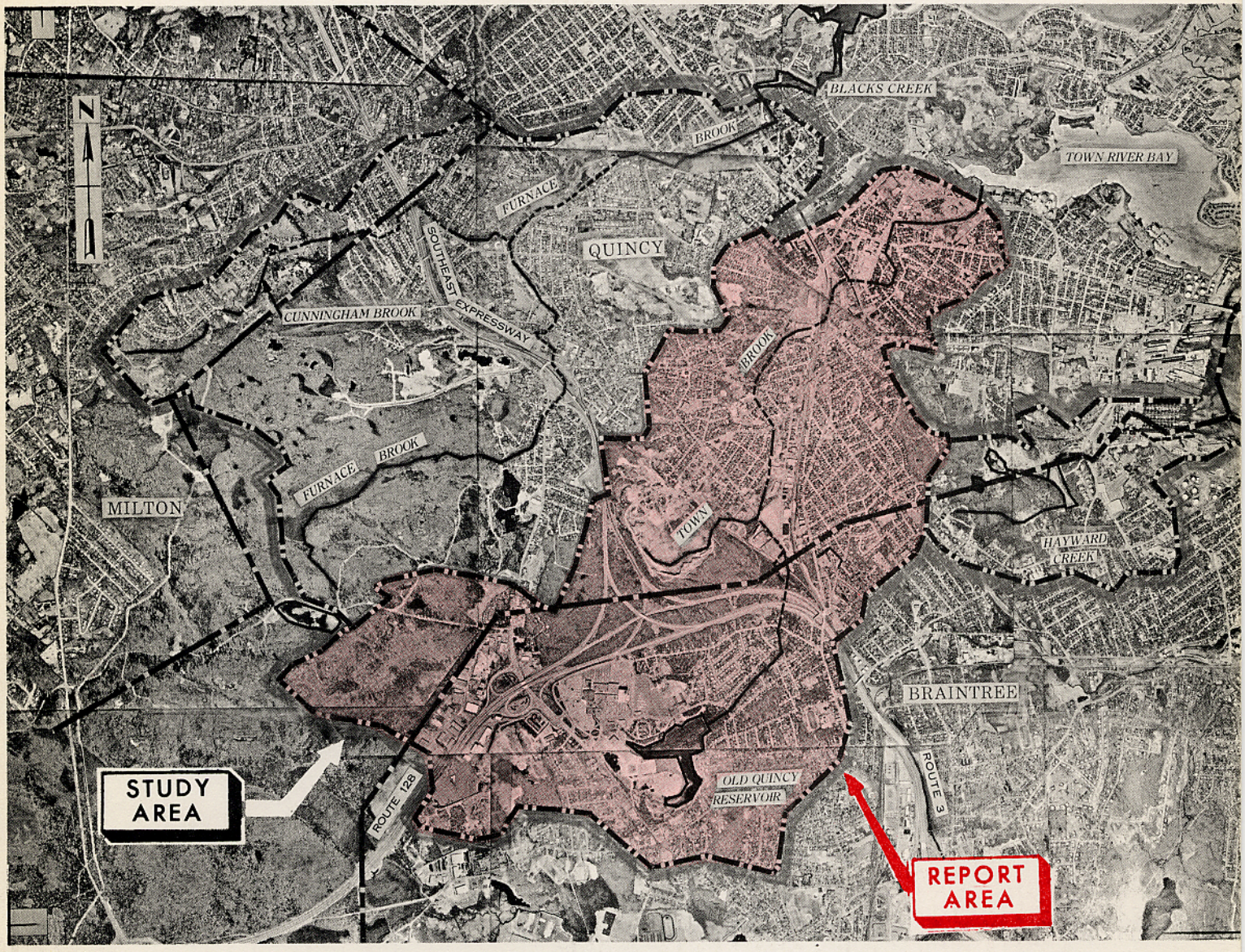
TOWN BROOK LOCAL PROTECTION

MASSACHUSETTS COASTAL STREAMS

FEASIBILITY REPORT FOR WATER RESOURCES DEVELOPMENT



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SEPTEMBER 1980

United States Army
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New England Division

TOWN BROOK LOCAL PROTECTION

MASSACHUSETTS COASTAL STREAMS

FEASIBILITY REPORT

FOR

WATER RESOURCES DEVELOPMENT

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASSACHUSETTS 02154

SEPTEMBER 1980

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INTRODUCTION

The Town Brook watershed is located in Quincy and Braintree, Massachusetts and is part of the Quincy coastal drainage system which includes Furnace Brook, Hayward Creek and other smaller streams. Because of repeated flooding (notably 1955, 1968 and 1969) on those streams in the lower basin east of the Southeast Expressway in Quincy, local interests requested Federal assistance by letter dated 20 June 1969. The New England Division undertook a study under the provisions of Section 205 of the 1948 Flood Control Act, as amended, to determine the feasibility of providing flood protection in Quincy, Massachusetts. A reconnaissance report, completed in November 1970, found that local flood protection projects appeared justified and that further studies were warranted.

STUDY AUTHORITY

Based on findings in the reconnaissance report, local interests subsequently made a request to local Congressmen for further flood control studies in Quincy. On 2 December 1970 the Committee on Public Works adopted a resolution requesting a study of flooding and other water resources problems along the coastal streams of Quincy. The Resolution reads as follows:

> "That the Board of Engineers for Rivers and Harbors is hereby requested to review the reports on Land and Water Resources of the New England-New York Region, transmitted to the President of the United States by the Secretary of the Army on April 27, 1956, and subsequently published as Senate Document No. 14, 85th Congress, First Session, and other pertinent reports, with a view to determining the advisability of improvements on Furnace Brook, Hayward Creek and Town Brook, all coastal streams within the City of Quincy and the adjoining towns of Braintree and Milton, Massachusetts, in the interest of flood control and allied purposes."

SCOPE OF STUDY

This interim report presents the study findings on flooding and other water resource problems in the Town Brook watershed. The watersheds of Hayward Creek and Furnace Brook, also included in the Resolution, are considered in separate studies. The location of the study area is shown in Figure 1.

The Town Brook feasibility study is of survey scope, referenced by the Water Resources Council as Level C. This level of study is generally undertaken for the purpose of recommending authorization or initiation of plans to solve water resources problems. The plan formulation process focuses on the preparation of plans to meet long term needs as identified by planning objectives for the area.

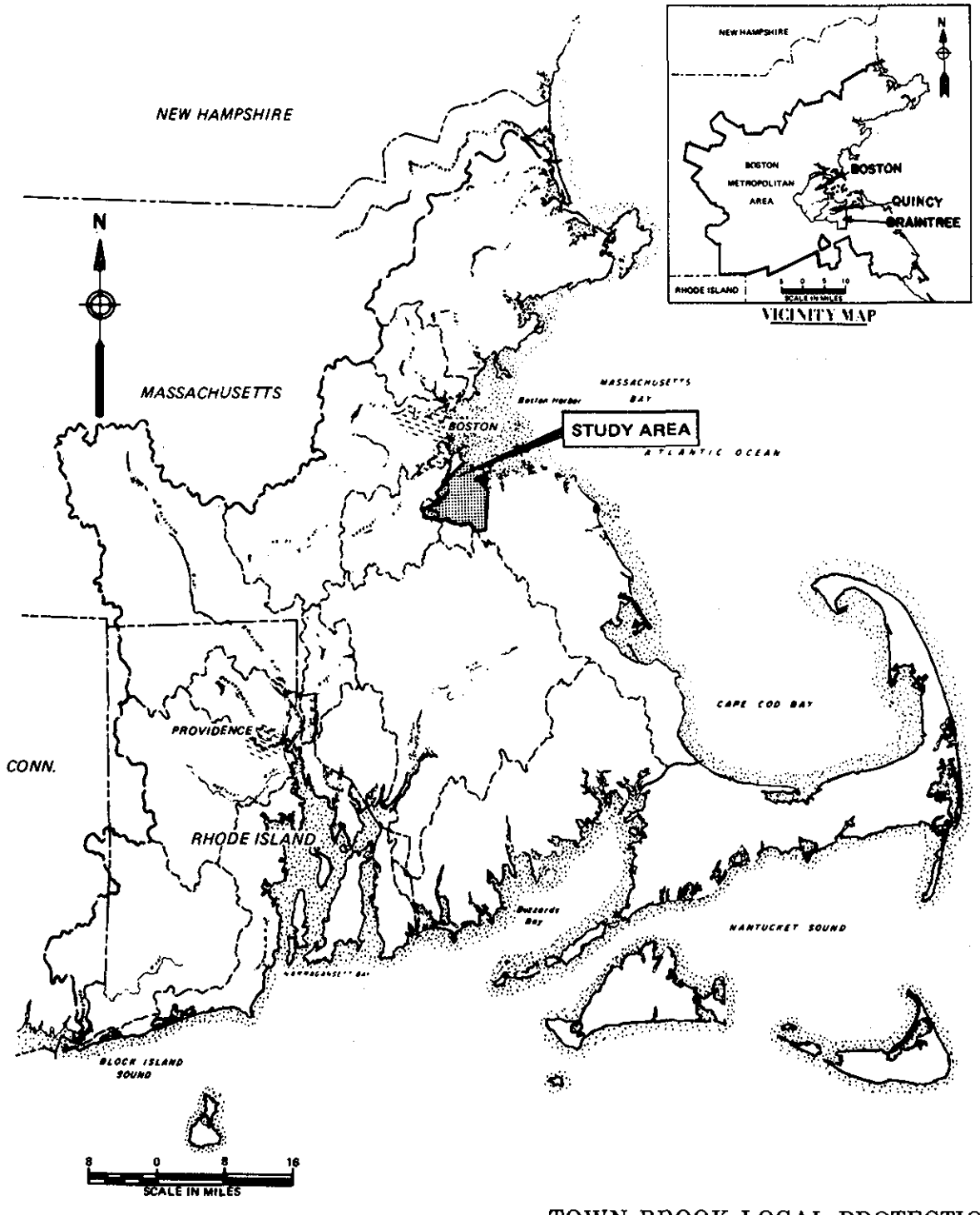
This study incorporates and updates information from previous studies in the area. Additional data and information were developed during the course of this study to fill in the detail needed to adequately formulate and analyze alternative plans of improvement.

All reasonable alternative measures to solve the area's water resources problems were considered and used to formulate alternative plans. The selection of the recommended plan was made after considering technical analyses and views of local interests and concerned agencies.

STUDY PARTICIPANTS AND COORDINATION

The Commonwealth of Massachusetts, through the Metropolitan District Commission (MDC), has taken an active role in the conduct and coordination of the study. Within the study area, a considerable number of civil works projects are being planned and constructed. The MDC has the major responsibility to coordinate these activities.

All studies for this report were coordinated with appropriate Federal, State and local agencies including: the U.S. Fish and Wildlife Service, Heritage Conservation and Recreation Service, National Park Service, Department of Housing and Urban Development, Soil Conservation Service, Environmental Protection Agency, New England River Basins Commission, the various



TOWN BROOK LOCAL PROTECTION
QUINCY AND BRAINTREE
MASSACHUSETTS

LOCATION AND VICINITY MAP

NEW ENGLAND DIVISION
CORPS OF ENGINEERS
SEPTEMBER 1980

FIGURE 1

resource agencies of the Commonwealth of Massachusetts, the city of Quincy, and the town of Braintree. This coordination involved conferences and informal meetings to discuss problems and needs and possible solutions; review and comments on drafts of the environmental assessment and reports; review of Section 404 Evaluation; and participation in the formal public meetings.

Three public meetings were held in Quincy. The initial meeting, 8 June 1972, provided an opportunity for local interests to express their views and to comment on some of the possible remedial measures that could be considered. The second meeting, 11 December 1975, was held to present alternative plans developed during the investigation and to ascertain the public's interest. The third meeting was held on 18 September 1980 to review with the public the results of the study and the selected plan, which is proposed in this report. The public responses are presented in Appendix C.

OTHER STUDIES AND REPORTS

This section summarizes studies and reports by the Corps and other Federal and non-Federal agencies that assess the water resources problems of the area and have a bearing on this study.

NENYIAC Report - A report by the New England - New York Inter-Agency Committee (NENYIAC), prepared prior to April 1956, considered all aspects of the land and water resources of the New England - New York region. Part I and Chapter 1, Part II, of this report have been published as Senate Document No. 14, 85th Congress, 1st Session. Chapter XVI, "Massachusetts Coastal Area." It described coastal flooding in the area and stated that flood problems have been aggravated by past land use and management practices. These have resulted in deterioration of watershed protective cover, leading to an increase in runoff and flood damage.

NAR Study - The North Atlantic Regional Water Resources Study (NAR Study), completed in June 1972, was authorized by the 1965 Water Resources Planning Act (Public Law 89-80) and the 1965 Flood Control Act (Section 208, Public Law 89-298) and was one of 20 comprehensive regional water and related land resources studies conducted throughout the United States under guidelines established by the Water Resources Council. The study developed a broad master plan of anticipated water resource needs of the people of the region, projected through the year 2020 to aid in future regional water resources development and planning. The water resource needs evaluated include water quality control, flood control, municipal and industrial water supply, irrigation, rural water supply, navigation, hydroelectric power, recreation, and fish and wildlife. The report of the study, issued in July 1972, has been formally

reviewed by all involved State, regional and Federal agencies, the Water Resources Council, and the Office of Management and Budget.

Wastewater Management Study - Another major study is the Boston Harbor-Eastern Massachusetts Metropolitan Area Wastewater Management Study (EMMA Study) involving 109 cities and towns. Its objective was the development of a plan for cleaning up the local rivers and Boston Harbor. This study, a joint project of the MDC and the Corps of Engineers, is intended to supplement ongoing Federal and State programs to meet the requirements of PL 92-500, the Federal Water Pollution Control Act Amendments of 1972.

SENE - The Southeastern New England Study (SENE) is a level B water and related land resources study. The study goal was to develop a resource management program to accommodate the sometimes conflicting demands for conservation and growth. The study was conducted by a team of Federal, State and local representatives under the overall coordination of the New England River Basins Commission. It was completed in 1975.

The study area encompasses river basins draining into the Atlantic Ocean, extending from the Merrimack River in Massachusetts to the Pawcatuck River at the Rhode Island-Connecticut line. The watersheds of Furnace Brook, Hayward Creek and Town Brook are included in the Boston metropolitan portion of the SENE study area. The scope of studies includes flood plain, streamflow, and inland wetland management; coastal and offshore resources; water supply and water quality control; recreation, fish and wildlife; power and urban water needs; and environmental factors.

NEWS - The Northeastern United States Water Supply Study (NEWS), completed in 1977, was initiated in 1966 following the unprecedented drought of the 1960's in the northeastern seaboard of the United States. In October 1965 Congress authorized the Secretary of the Army to cooperate with Federal, State and local agencies in preparing plans to meet the long-range water needs of the Northeastern States. The study considered all reasonable alternative plans to solve the region's water supply problems, and several plans were studied in detail.

Flood Insurance Studies - A flood insurance study report for the city of Quincy, prepared by the New England Division, Corps of Engineers for the Federal Insurance Administration, was published in February 1972. The city of Quincy adopted the study recommendation and is now eligible for flood insurance under the regular flood insurance program.

A flood insurance report for the town of Braintree was also prepared by the New England Division, Corps of Engineers for the Federal Insurance Administration. The town of Braintree adopted the study recommendation and is now part of the regular flood insurance program.

Reconnaissance Reports - An unpublished reconnaissance report, completed in November 1970 by the New England Division, Corps of Engineers, presented the findings of a preliminary flood control study of the Town Brook area. The report stated that local protection works would be feasible, but

would exceed the $1 million cost limitation then applicable under the authority contained in Section 205 of the 1948 Flood Control Act.

A water resources investigation and a plan of survey were developed by the New England Division in 1973 for the Quincy coastal streams which include Town Brook, Furnace Brook and Hayward Creek. This plan outlines the direction and procedures of required studies.

Hayward Creek Report - The feasibility and detailed project reports for Hayward Creek local protection were completed in August and October 1974, respectively, and the project has been completed. The final plan included raising Hayward Pond Dam and constructing a new outlet works, a new earth dam to provide temporary flood storage in the wetlands above Hayward Pond, a new stream channel to divert Echo Creek into the wetlands, other structural features including an enlarged discharge conduit to Weymouth Fore River, and the acquisition of a 33-acre natural greenbelt area at Hayward Pond and wetlands upstream. The Hayward Creek project was constructed in 1978 under Section 205 at a cost of $2,630,000.

THE STUDY PROCESS AND REPORT

The Corps of Engineers and the Metropolitan District Commission (MDC) have followed a systematic approach in the study by analyzing needs and problems, establishing planning objectives, and developing and evaluating alternative management plans. This approach is directed by the Water Resources Council's Principles and Standards (P&S) which provide the guidelines for Federal water resources planning activities.

The MDC, to expedite the planning process, provided funds and hired consultants to study the Town Brook flood problem area. This work was done in close coordination with the New England Division to assure the adequacy of the study. The Corps has used this work as the basis for final studies, the plan selection process and this feasibility report.

The study process was directed to meet Federal and Corps guidelines, reflect concerns of citizens, address needs and problems of the area, meet the requirements of the National Environmental Policy Act (NEPA), maintain coordination with other agencies and encourage and obtain public participation.

The report is presented in two parts: the main report and appendices. The main report presents the results of the feasibility studies and a broad view of the overall study. The appendices contain the detail and technical data to support the main report

PROBLEM IDENTIFICATION

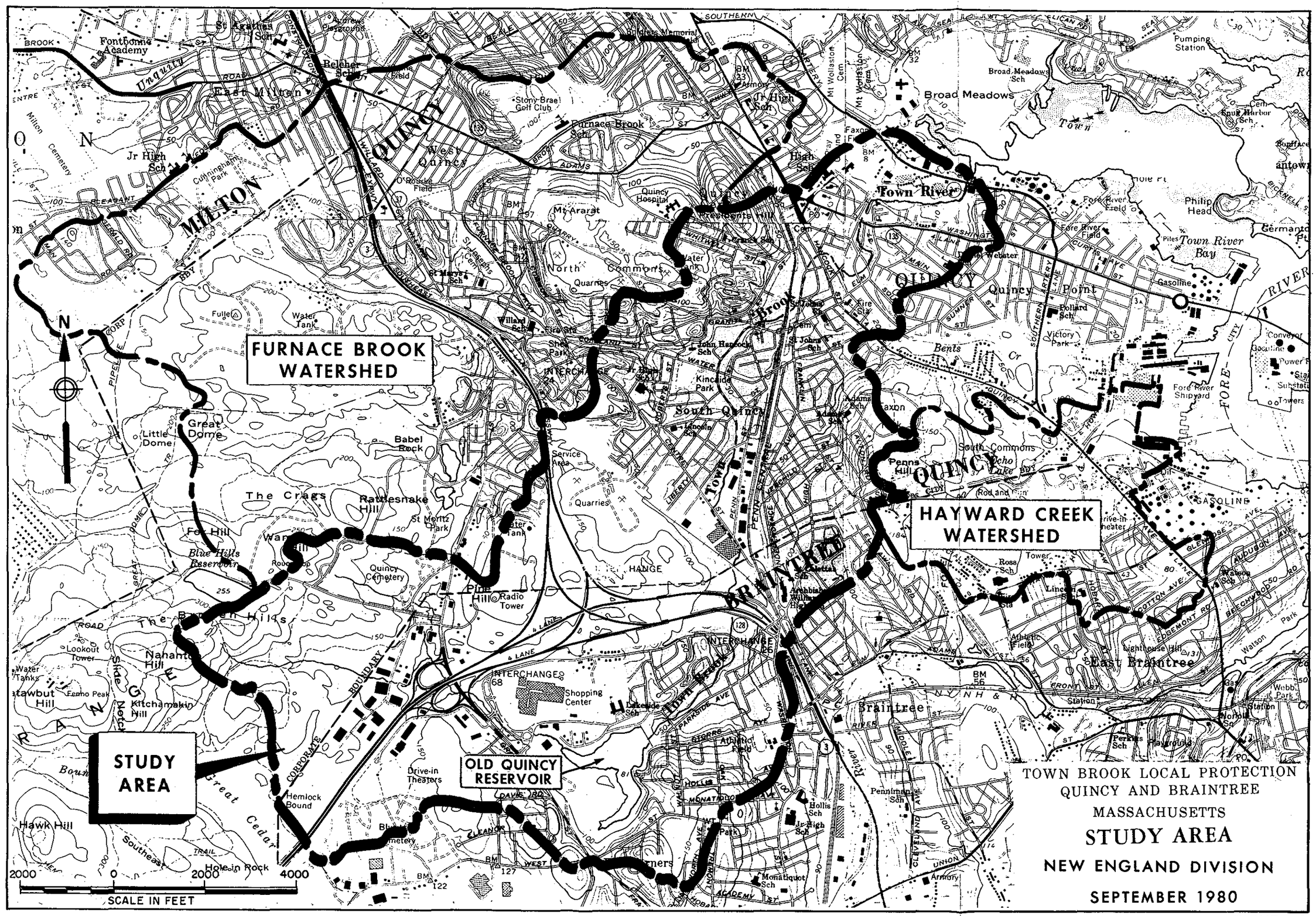
In the problem identification task, public concerns are identified, present and future conditions are assessed, and planning objectives are established to provide a meaningful guide for subsequent activities.

NATIONAL OBJECTIVES

The P&S require that planning will be directed to achieve National Economic Development (NED) and Environmental Quality (EQ) as equal national objectives. The NED objective is achieved by increasing the value of the Nation's output of goods and services and improving the national economic efficiency. In the case of Town Brook, this could take the form of addressing flood damage reduction. The EQ objective is achieved by the management, conservation, preservation, creation, restoration or improvement of the quality of certain natural and cultural resources and ecological systems. Applicable resources in Town Brook include wetland areas, historic sites and fish and wildlife resources.

THE STUDY AREA

Town Brook is located in the city of Quincy and the town of Braintree about 7 miles south of Boston. The watershed area, shown in Figure 2, covers approximately 4.5 square miles.



TOWN BROOK LOCAL PROTECTION
QUINCY AND BRAINTREE
MASSACHUSETTS
STUDY AREA
NEW ENGLAND DIVISION
SEPTEMBER 1980

FIGURE 2

Climate

The climate, with an average annual temperature of 50°F, is tempered by the sea, which produces a cooling effect in summer and a warming effect in winter. Annual precipitation varies substantially from year to year, but frequently is not far from a mean of 43 inches. Precipitation is generally uniformly distributed throughout the year, but with significant monthly variations from year to year. Snowfall frequently occurs during the four winter months, although accumulations are normally not significant. Occasional flooding is augmented by warm rains and melting snow combined with frozen ground conditions to increase the rate of runoff during winter thaws or the spring freshet season.

Heavy precipitation, usually of short duration, is common throughout the year. Occasional major storms of longer duration and intermittent high intensity known as "northeasters" are usually the cause of major flooding problems.

Water Resources

Town Brook starts in the Blue Hills Reservation as a clear, upland stream. Where it encounters highway, commercial and residential development, it is controlled by culverts, conduits and walled banks. Town Brook then enters Old Quincy Reservoir, the former water supply source for the city of Quincy. Now used only for industrial water supply, the reservoir offers passive recreation, plant and wildlife habitat, and a scenic area. Downstream from the reservoir, the brook flows as an open channel through a residential area in Braintree for a short distance, but then is contained in an underground conduit for much of its length until after it passes under the downtown shopping area of Quincy. Here the Town Brook channel, with its rock walls, adjoining grass strips, and small shrubs and trees, provides pleasing visual relief in the urban setting.

In its lower reaches, Town Brook comes under tidal influence and widens to become Town River before it enters Town River Bay. The Town River segment of the system is a saltwater marsh, one of the most significant natural systems in the watershed.

Water Quality

Town Brook and Town River have been assigned objective water quality classifications of Class B and Class SB by the Massachusetts Water Resources Commission. Class B standards apply to the inland waters of the streams, and Class SB standards apply to the marine waters. Both Class B and SB waters are suitable for the propagation and protection of fish, wildlife and aquatic life and for primary and secondary recreation. As defined by the standards, Class SB waters also support shellfish harvesting with depuration, a process which makes the shellfish suitable for eating. Specific criteria applicable to B and SB waters are presented in Appendix D. Based on the available data, water quality conditions in Town Brook and Town River may be expected to marginally meet the requirements for Class B and SB waters.

Natural Resources

The natural resources, although limited, are of special value because of their proximity to the large population concentrated in the Boston area.

The upland portion of the watershed contains plant and animal life normally associated with an urban or suburban setting. In the residential neighborhoods within Braintree there are many species of songbirds and some species of small game such as rabbits, squirrels and pheasants. Within Quincy there are many species of songbirds and some small game in the vicinity of the Blue Hills Reservation and Faxon Park. The remaining areas of Quincy have wildlife essentially associated with an urban environment, such as pigeons, starlings and English sparrows. Although the watershed has a wide variety of flora and fauna, no rare or endangered species were identified. Appendix G contains more detailed information on the natural resources of Town Brook watershed.

An 8 to 10 acre freshwater wetland occurs in a 60 acre wooded site between Route 3 and Center Street in Quincy. The area supports a variety of wetland vegetation and provides habitat for small mammals and a nesting area for ducks.

The 5-acre saltwater marsh at the lower end of the watershed supports a relatively dense growth of marsh vegetation over a layer of deposited organic material. The marsh provides a variety of habitat for birds and mammals not found in the otherwise heavily developed city of Quincy, and it also functions as a major link in the food web of the river and Town River Bay.

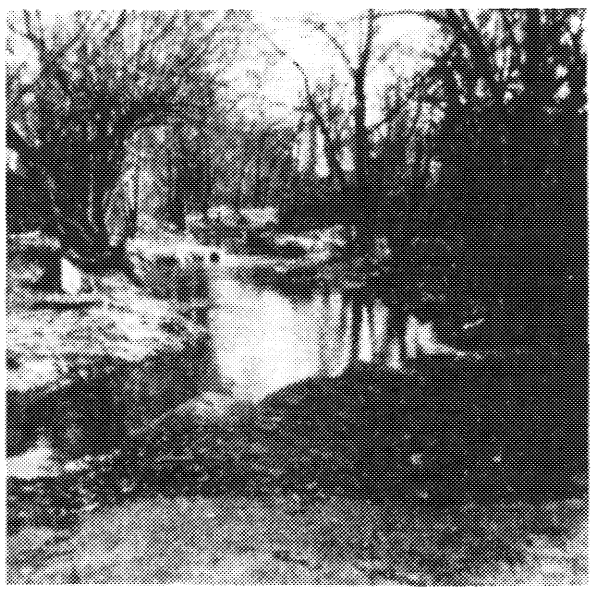
In the lower reaches of Town Brook, rainbow smelt utilize the concrete walled channel for spawning. The substrate is suitable for spawning and it appears the water quality is generally satisfactory for both smelt spawning and egg development. However, unidentified adverse conditions in the brook have, on occasion, resulted in heavy mortality of spawning smelt.

Geology and Topography

The topography of the watershed varies from gently rolling hills in the Blue Hills Reservation in the western section of the watershed to flat wetlands (salt marsh) at the mouth of the Town River in the easterly extremity. Elevations range from 0 to 300 feet above mean sea level.

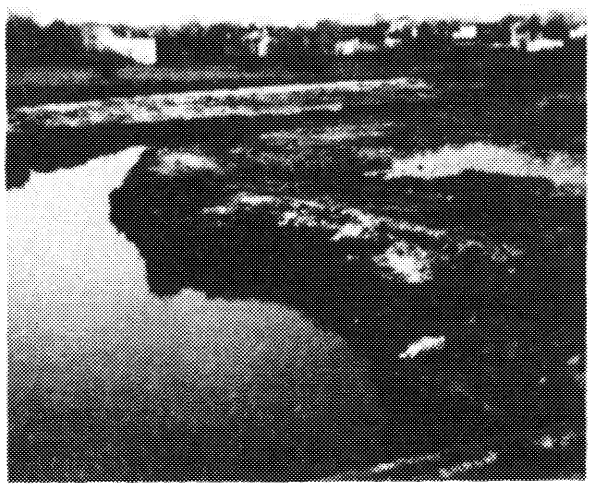
The Town Brook watershed is underlain in large part by igneous rocks of the Blue Hills Ridge. On a regional scale, this is located in the New England lowlands portion of the northern Appalachian Mountains. Bedrock in the watershed area is covered by glacially deposited sand and gravel and by artificial fill. Bedrock formations specifically present beneath the site are the Weymouth and Braintree argillite formations, the Quincy granite, and the Mattapan volcanics. Their general distribution is indicated on the map of bedrock geology map in appendix E.

OLD QUINCY RESERVOIR



TOWN BROOK UPSTREAM OF WORTHINGTON CIRCLE - BRAINTREE

TOWN BROOK DOWNSTREAM OF REVERE ROAD - QUINCY



TOWN RIVER UPSTREAM OF SOUTHERN ARTERY - QUINCY

Overlying the bedrock, there is an array of glacial and recent soil deposits, as shown on the surficial geology map in appendix E. Covering most of the area is glacial till, an unsorted, compact mixture of sand, gravel, silt, clay and boulders. Its average thickness is 10 to 20 feet. The more recent deposits of sand, silt and peat have accumulated along streambeds such as Town Brook. A significant portion of the surficial geology has been covered or replaced by artificial fill. In the eastern, fully developed half of the area, especially, 3 to 5 feet of fill is almost always present.

Socioeconomic Resources

Economy - During its first two centuries, Quincy was mainly an agricultural community until the expansion of the shoe trade brought an outgrowth of tanneries along Town Brook in 1830. The quarrying of granite with its technological advances became a significant activity. In the late 1800's, the Fore River saw its first shipbuilding activities. In 1913, the Bethlehem Steel Corporation took possession of this shipyard which soon became one of the greatest in the world.

Today, Quincy's economy is based on the manufacturing industry, although this industry's importance has lessened. The largest single employer is General Dynamics, one of the nation's most important shipbuilding facilities. although significant increases in employment were noted in the finance/insurance/real estate and services sectors in recent years, they were not great enough to offset an overall decline in employment.

Population - Quincy, as a matured urban community, has had neither a dramatic increase or decrease in population growth. The rate of growth itself over the past 15 years has varied between 0 and 1.9 percent which would characterize the city as a slow growth community. Quincy's 1975 population was recorded at 91,494 with 1990 projections suggesting a population of 95,500, a 4.8 percent increase from 1975.

Land Use - Residential use predominates the developed land area in Quincy. Approximately 50 percent of the city's dwelling units are in single family homes with the bulk of new housing development in multifamily structures. Residential uses are concentrated in the north and northeast sections of the city, since almost a third of Quincy is within the Blue Hills Reservation in the southwestern portion of the city.

The greatest concentrations of industrial development have occurred around Town River Bay and along the Penn Central Railroad tracks. The most significant commercial development is Quincy Center in the area of Granite, Hancock, and Washington Streets. Additional details on land use are in Appendix A.

The flood prone areas within the project area being considered by the Corps are characterized by a mix of commercial and residential developments. The majority of structures within each of the "pools" is residential with the exception of the Shopping Center pool which includes the stores and shops which compose the bulk of Quincy Center.

Transportation Facilities - A good transportation system is characteristic of the economic base area. The communities involved are serviced by several bus lines, as well as the Massachusetts Bay Transportation Authority (MBTA). There are several major highways located in or near the area, making travel to and from Boston and other towns in the metropolitan area convenient.

Of growing importance in the transportation picture is the South Shore Extension of the MBTA's rapid transit Cambridge-Dorchester line which opened in 1971. In March 1980 the line was extended to Braintree just south of the watershed area. An MBTA station is being constructed in south Quincy adjacent to Town Brook. This is a major construction effort involving new access ramps to Route 3, a connector road to downtown Quincy and major drainage works to reduce flooding potential from Town Brook.

Historic Sites - The Town Brook watershed has an unusual historical background, in that it is the only area in the United States in which the birthplace of two presidents can be found. In 1779, the Constitution of the Commonwealth of Massachusetts, the model for the Constitution of the United States, was written at the birthplace of John Quincy Adams. The homes in which John Adams and John Quincy Adams were born are registered as National Historic Landmarks.

Other valuable historic resources include the Quincy City Hall, the First Parish Church, the Abigail Adams cairn, and the remains of the former Town Brook Canal, see photo following page 12.

Recreation Areas - There are several open space and recreation sites within the watershed including the Blue Hills Reservation, preserved as open space by the MDC. The reservation includes wetlands, streams, hills, rock outcrops and woodlands that provide an ideal setting for hiking and nature study. The MDC will continue to maintain this resource for future use.

The Old Quincy Reservoir is frequently used for unsupervised swimming by local teenagers. Although swimming is not authorized, this site has potential for use as a passive recreation facility.

Faxon Park provides residents of the eastern section of the study area with opportunities for both active and passive recreation. The park has baseball diamonds and athletic fields, and a proposal has been approved recently by the Quincy City Council to upgrade and expand facilities to include tennis courts and a new playfield.

Several other parks in the city of Quincy outside the watershed provide active recreational opportunities for residents of the watershed.

The continued expansion of the local recreation program and facilities promises to offer new recreation experiences for local residents. Because of this effort, local interests expressed no desire to make recreation a part of the Town Brook study.

PROBLEMS, NEEDS AND OPPORTUNITIES

The problems, needs and opportunities presented in this section were identified through technical analysis and the assistance of local officials and citizens.

Flood Damages

The immediate and critical water resource need for the Town Brook watershed is for control of floods in the urban areas of the flood plain. The primary source of flooding is associated with storm systems of long duration, i.e., 12 hours or more, which travel northeastward up the Atlantic seaboard producing intense rainfall. These are the "northeasters" and hurricanes. The area is also exposed to continental storms and to summer thunderstorms which move across the region.

The two most damaging floods on Town Brook in recent years are those of August 1955 and March 1968.

Flood of August 1955 - The greatest flood on record from Town Brook occurred in August 1955 as a result of rainfall associated with Hurricane Diane. This storm produced about 5.3 inches of rain in a 6-hour period; and although the upper watershed was relatively undeveloped at that time, the resultant flooding was the greatest in Quincy's history. Flooding also occurred in Braintree when Old Quincy Reservoir overflowed its north bank into Lakeside Drive and water flowed across the adjacent residential area. The recurring flood damages for a flood of this magnitude (approximately the 100-year flood) would be $13,470,000.

Flood of March 1968 - The second greatest flood, was produced by a storm with a 6-hour rainfall of 2.5 inches and an 18-hour total of 5.7 inches. Flooding was intensified by high antecedent moisture and frozen ground conditions that prevented infiltration. As a result floodwaters covered about 175 acres of mostly urban land. The recurring losses for a flood stage elevation equivalent to the 1968 event would be $2,770,000 (April 1980 price level). In 1968 water also overflowed the north bank of Old Quincy Reservoir into adjacent residential areas. High water marks were documented to delineate the approximate flood plain, as shown on the flood plain maps in Figure 3.

Within the 175-acre flood plain there are about 190 residential, 87 commercial, 10 industrial and 5 public properties which are susceptible to flood damages. Major city roads would be flooded and traffic flows disrupted. Further detail on properties susceptible to flood damages is included in Appendix A.

Less severe floods in Town Brook have occurred in 1954, 1961, 1969, 1973, 1974, 1975 and 1979. Flood frequency and magnitude have been increased by continued development in upstream areas and further encroachment and restriction of Town Brook where it flows through the urban areas.

The floods of 1955 and 1968 were infrequent events. The 1955 flood is estimated to have about a 1 percent chance of recurrence. Estimates indicate a 1968 flood recurrence of 7 to 25 years, depending on location.

Flood Plain Areas

During flood periods, Town Brook does not have the capacity to carry runoff from a developed watershed. Town Brook has been almost completely modified in the developed lower reaches of the brook. The system of culverts, underground conduits and walled channel sections has been designed and built over the past 100 or more years.

During floods, water is temporarily stored in six pools that form along the route of Town Brook below the Old Quincy Reservoir. These pools shown in Figure 3 are identified below. Additional detail on flood plain area is shown in Appendix D.

"Braintree Pool" - results from backup of floodwaters due to the high invert elevations of the culverts under Route 3, and to the restriction imposed by the conduit running from Worthington Circle to Common Street.

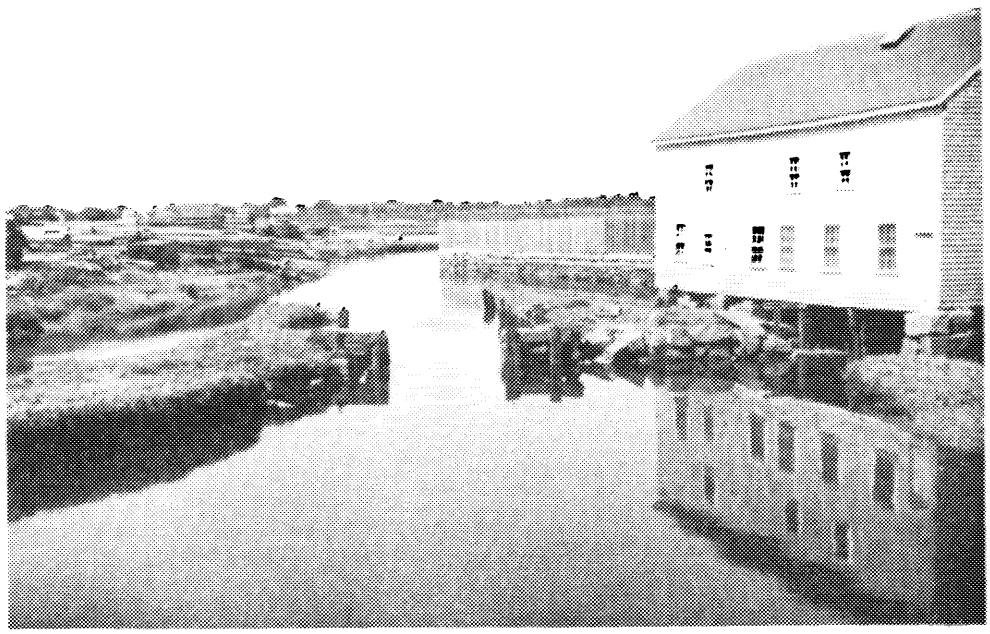
"Centre Street Pool" - is created by an inadequately sized 72-inch concrete pipe conduit beginning west of Columbia Street. It covers a large area, mostly west of Centre Street.

"Brook Road Pool" - is created by the restriction of a long, flat section of 8.5 x 5 foot concrete box. The pool lies along Brook Road and extends west along Water Street and both south and northeast of Water Street.

"Shopping Center Pool" - is a pool created by the restriction of the 10 x 5 foot box culvert under the railroad tracks and Quincy business district.

"Bigelow Pool" - is induced by the inadequate 10 x 4.8 foot culvert at the lower crossing of Bigelow Street. It results from the overflow of the walled channel section below Revere Road.

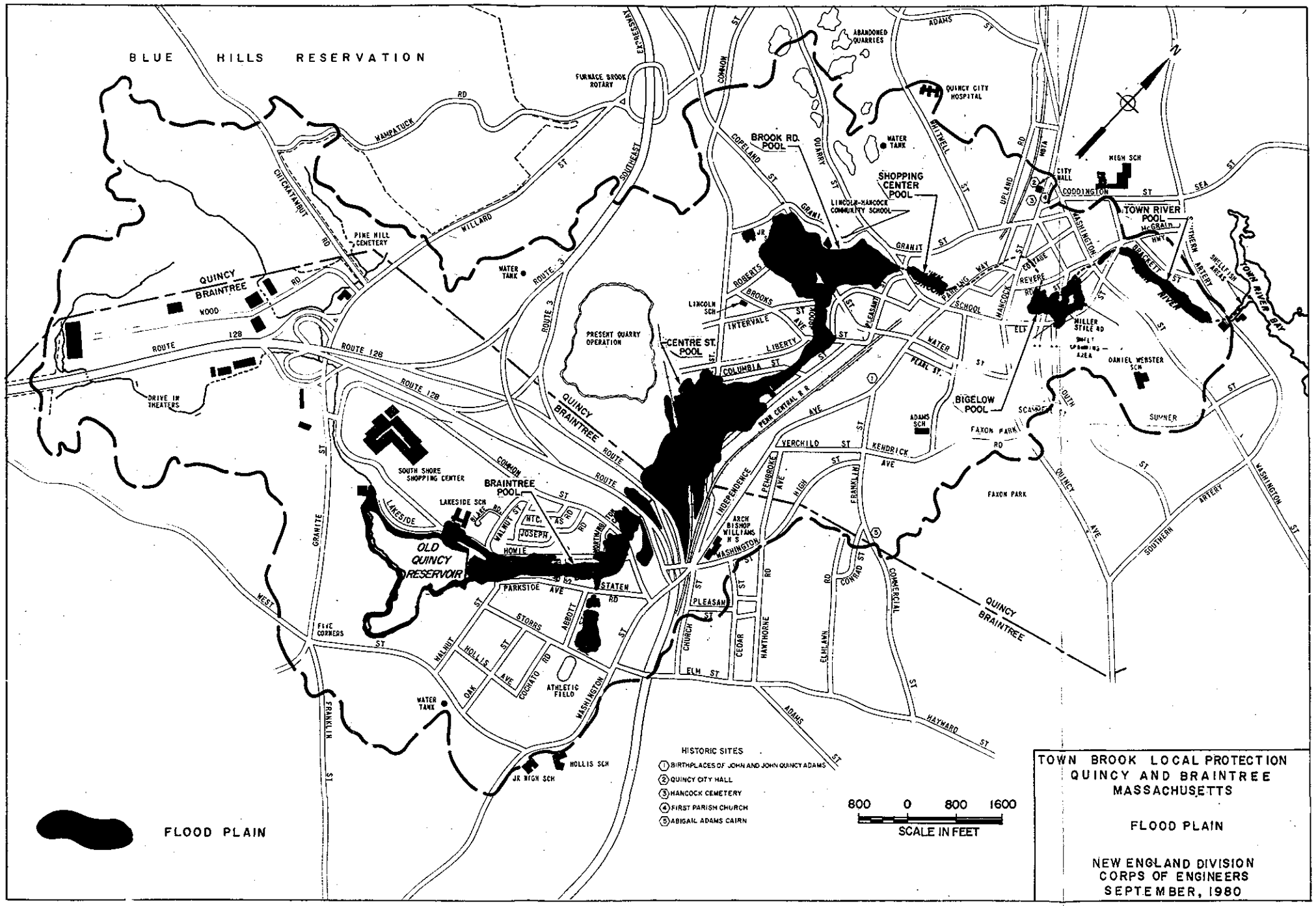
"Town River Pool" - extends along Town River below Elm Street. It is induced by the constriction caused by fill with only two 72-inch culvert pipes under the parking lot west of the Southern Artery.



REMAINS OF LOCK AND DAM FROM
THE FORMER TOWN BROOK CANAL

CORPS OF ENGINEERS

U. S. ARMY



TOWN BROOK LOCAL PROTECTION
QUINCY AND BRAINTREE
MASSACHUSETTS

FLOOD PLAIN

NEW ENGLAND DIVISION
CORPS OF ENGINEERS
SEPTEMBER, 1980

FIGURE 3

Since this study's identification of several of the restrictions that cause flooding, the MDC has been working with the town of Braintree and the city of Quincy to design a system to improve the capacity of Town Brook. Some of this will be done in conjunction with ongoing transportation improvements and/or as part of the improvement of the urban drainage system (see section on Without Project Condition).

The flooding problem at the "Shopping Center Pool" is caused by an inadequately sized channel (primarily underground) for Town Brook, which passes through the downstream business district of Quincy. Floodflows at this point are 1300 cfs and cannot be handled by normal urban drainage improvements. The problem of the inadequately sized culvert is compounded by the MBTA tracks, which act as a dam and back water up into the Brook Road Pool. The flooding in this area is several feet deep in residential and industrial areas. Also, when Town Brook is flowing full under the business district, the water is under pressure, which makes local drains inoperative, and backs up into the basements of several stores. It is difficult to pinpoint all sources of flooding in this area as the drainage system is generally unmapped and seepage compounds the problem.

The Old Quincy Reservoir Dam has been studied through the National Dam Inspection Program. It is classified as having high hazard potential, and several deficiencies have been noted. The floods of 1955 and 1968 both overflowed the north bank of the Old Quincy Reservoir. Such conditions create a serious risk of washing out the earth dam, which would create a catastrophic flood in the densely populated lower basin. There is an urgent need for increased spillway capacity to eliminate this hazard.

In order to utilize the storage potential of this reservoir for flood control, it is necessary to maintain a normal pool level well below the spillway crest. This is now done by manual operation of the valve on the reservoir drain line. To insure automatic operation, an overflow weir with a fixed crest set at an appropriate low level is needed.

Natural Resource Preservation and Enhancement

During the course of study the following resource issues surfaced during public meetings, discussions with Federal, State and local officials and technical studies.

Smelt Spawning - Town Brook has a sizeable smelt run, an important factor since the number of smelt in the region has decreased significantly in the last 50 years. The smelt spend most of their life in saltwater, in this case Town River Bay, and ascend freshwater streams in the spring to spawn. The primary spawning area in Town Brook is in the vicinity of Miller Stile Road, where bottom substrate and water conditions are favorable for smelt spawning.

Salt Marsh - In the lower reach of the watershed Town Brook widens to become Town River. The portion of Town River upstream of the Southern Artery is a salt marsh, a significant natural system in the watershed. Although it appears that a large portion of the marsh has been filled in the past for

development, about 5 acres of productive marshland remain. Protection of this marsh is an important goal of this study.

Water Supply

Communities in the Town Brook watershed are currently on the MDC water supply system. There is no potential local desire to meet future needs from within the watershed. The Old Quincy Reservoir, once the water supply source for the city, was abandoned in favor of the present source. With no local interest water supply as a purpose was not included in the study.

Water Quality Considerations

Town Brook and Town River are located in a very heavily urbanized area of eastern Massachusetts. As such, conditions in the streams are greatly influenced by man's activities. Urban stormwater runoff has the potential for seriously degrading water quality from the present B and SB classification by introducing a myriad of contaminants such as oils, grease, lead, organic and inorganic solids and nutrients. The vulnerability to contamination must be considered in any development of the water resource.

WITHOUT PROJECT CONDITION

The without project condition estimates the most probable future of the region as well as the Town Brook watershed area. These projections assume no new Federal water resource projects in the watershed. Discussion will cover categories that are significant both to the area itself, and to the formulation and evaluation of alternative plans.

Regional Overview

All indications point to a continued strong economy. Increases in the industrial base of Braintree and Quincy are expected to continue through 1990, when the area should be fully developed. Employment for 1990 in the two towns is expected to increase by 60 percent over the 1977 level.

Population in the two communities is expected to increase by about 7.5 percent by 1990 from its 1975 population. Housing will be provided largely through multi-unit residential development.

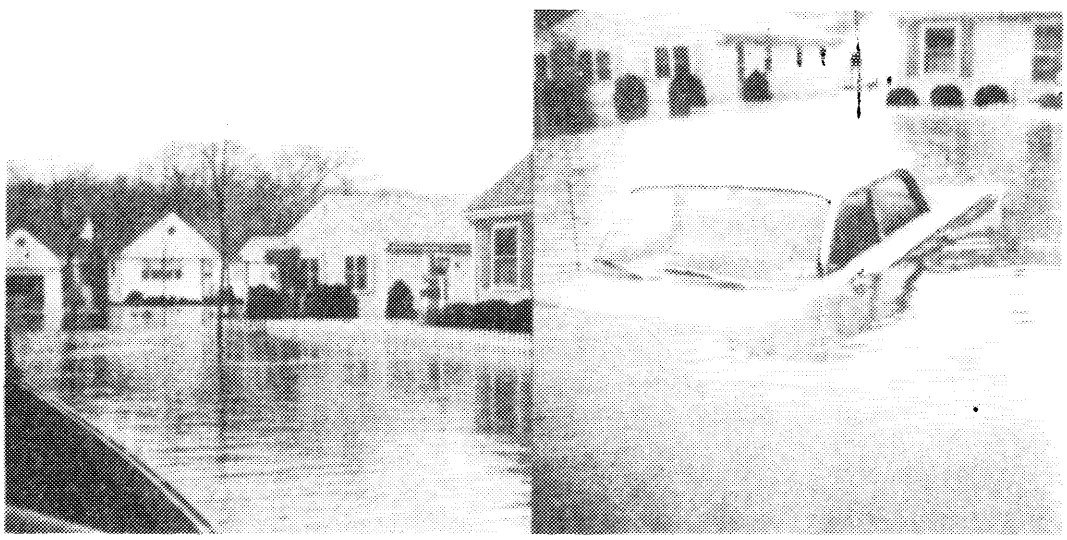
WALNUT STREET AND HOWIE ROAD BRAINTREE - MARCH 1968

BACKYARD 134 HOWIE ROAD - BRAINTREE - MARCH 1968

ACORN STREET
BRAINTREE – DECEMBER 1969
COMMON STREET

LOOKING EAST
MARCIA ROAD BRAINTREE – DECEMBER 1969
LOOKING NORTH

TOWN BROOK LOOKING NORTH FROM MILLER STILE ROAD - QUINCY
FEBRUARY 1886



PAYSON STREET - QUINCY
MARCH 1968

Local (Watershed) Perspective

The economic strength of the region is likely to be reflected in the Town Brook watershed area, where available land is expected to be developed to its ultimate capacity. Both industrial and residential development are anticipated. New transportation facilities are presently being constructed. The inevitable result of all this development will be an increase in runoff rates and flooding in the Town Brook watershed.

The new transportation improvements being planned and constructed in the watershed will have a significant impact on the area. The new MBTA station and parking garage and a new highway interchange to Routes 3 and 128 will make this a regional transportation center. Also the Bergin Parkway, a proposed connector road to the downtown Quincy business district will overcome a long-standing access problem. The MBTA Station and the Quincy business district are vulnerable to Town Brook flooding.

Urban Drainage Plans - Analyses during the course of the Town Brook studies from 1972 to 1980 have identified the need for an improved urban drainage system in Braintree and Quincy as well as the need for flood damage reduction. The design and implementation of these drainage improvements has already begun and will be coordinated with the flood control plan for Town Brook.

These proposed improvements, as shown in Figure 4, will remove stormwater out of urban areas into Town Brook and eliminate or compensate for the restrictions of Town Brook's inadequate flow capacity. However, the system cannot be fully effective because of the inadequate capacity of Town Brook to carry floodflows.

The urban drainage system is planned for stream reaches starting just downstream of the Old Quincy Reservoir. Upstream of Route 3, the larger culverts will replace inadequate culverts currently in place and will have sufficient capacity to pass the 100-year flood without overtopping local roads. The new culverts under Route 3 have already been installed as part of highway construction currently underway. These culverts (twin 9-foot x 6-foot box culverts) will add sufficient capacity to prevent ponding, resulting from a 100-year event, on the upstream side of the highway. This system of culverts will essentially eliminate flooding in the Braintree pool during a 100-year flood.

Downstream of Route 3 the water will be allowed to flow across the present wetland area. Normal flows and untaxing high water flows will be allowed to flow down the present Town Brook channel, or underground culvert as the case may be. Excess flows will be picked up by a major relief conduit with an inlet on the edge of the wetland adjacent to the railroad tracks (see Figures 4 and 8). The relief conduit will be built in conjunction with the proposed Burgin Parkway with construction scheduled to begin in 1981. The relief conduit will terminate at Town Brook adjacent to School Street and is being designed with the assumption that an adequate outlet will be provided. The capacity of the present Town Brook channel and the relief conduit is sufficiient to carry flows from the 100-year storm and essentially eliminate

flooding in the Center Street pool for this frequency of flooding. When combined with the relief conduit planned for the Lincoln-Hancock School area, sufficient capacity will also be available to carry 100-year flows from the Brook Road pool. The benefit of these conduits cannot be realized until an outlet is provided since the present culvert under the MBTA tracks is a serious restriction.

The relief conduit planned along Revere Road in downtown Quincy will serve to cut off local drainage and carry it to Town River.

Flood Damage - Average annual flood damages of $2.1 million would continue to result from flooding on Town Brook. Extensive structural damages will still occur in the Brook Road, Shopping Center, and Bigelow Street pools.

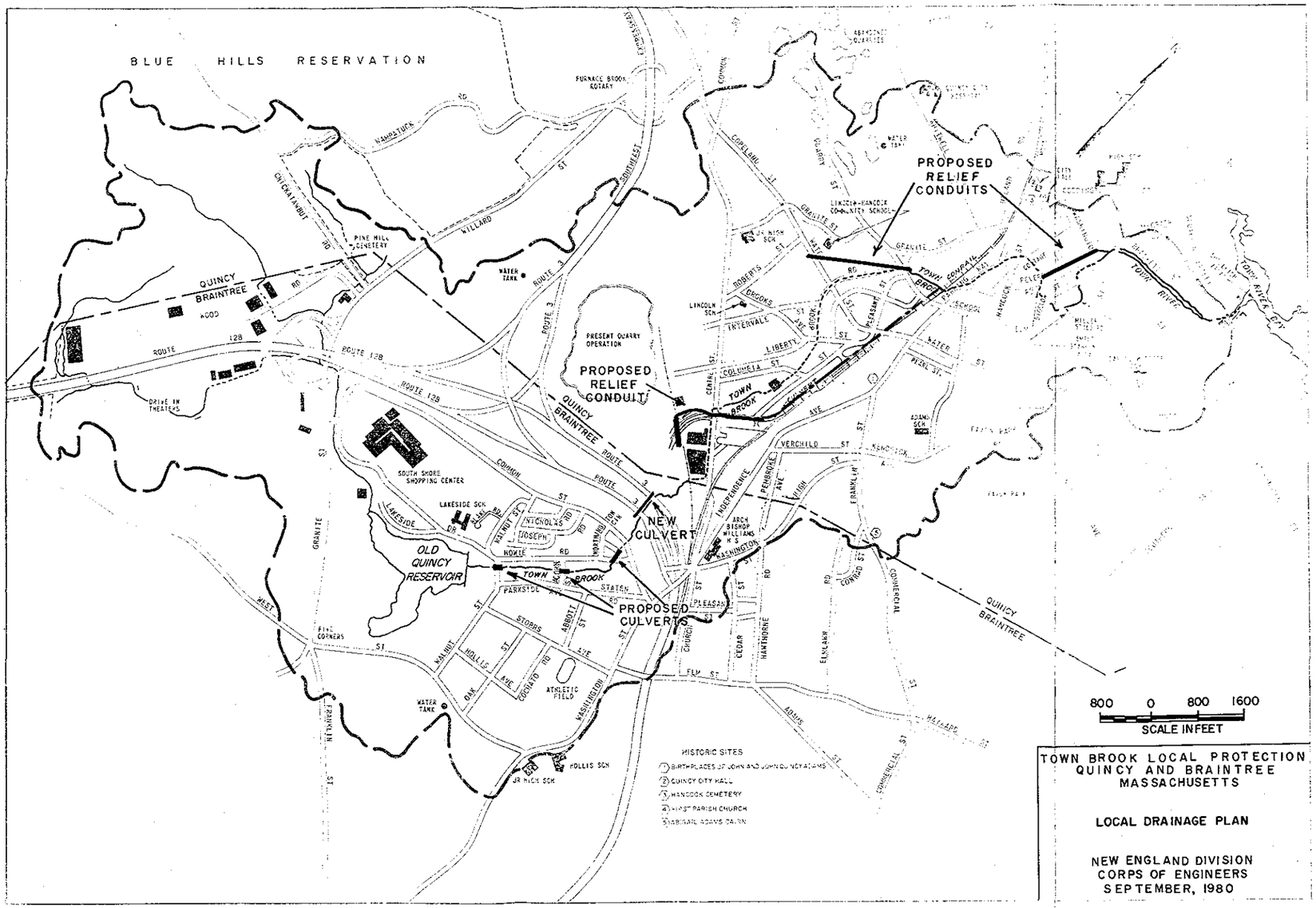
Continued flooding in downtown Quincy would not only result in structural and property damages to homes and businesses, but also would result in lost wages to local employees and lost business to establishments forced to close down. Social costs are incurred when services and goods become inaccessible to consumers and transportation problems inconvenience commuters. The occurrence of a flood event would continue to place a burden upon support services, in responding to an emergency situation as well as the repair of roads and damaged utilities after the flooding has subsided.

Natural Resources. The watershed area is characterized by its urban nature and will continue to be. Major open space areas, the Blue Hills Reservation, and Faxon Park are likely to be preserved. Federal and local regulations will help preserve the wetland areas, but this is not guaranteed and development on a piecemeal basis could occur.The wetland could also change through the natural environmental processes such as erosion of channel banks and deposition of sediment.

The smelt spend most of their time in the saltwater environment of Town River Bay and are not dependent on Town Brook alone. The smelt habitat and smelt spawning runs will probably continue in their present status, which has diminished in recent years. Should a major interruption occur, the smelt run could be reestablished through stocking with eggs or fry.

The water quality of Town Brook will continue to be subjected to the impacts of urban development and runoff, which presently add contaminants and excess nutrients. Citizen interest in conjunction with Federal and State programs will be the major forces to maintain water quality although there will be periods when the system will be taxed.

CORPS OF ENGINEERS — U. S. ARMY



TOWN BROOK LOCAL PROTECTION
QUINCY AND BRAINTREE
MASSACHUSETTS

LOCAL DRAINAGE PLAN

NEW ENGLAND DIVISION
CORPS OF ENGINEERS
SEPTEMBER, 1980

FIGURE 4

PLANNING OBJECTIVES

The planning objectives for this study have evolved throughout the course of this study and are based on interaction with the public and other agencies. Planning objectives for the period 1980 to 2080 are:

. Reduce flood damages in the industrial, commercial and residential areas of the Town Brook flood plain.

. Contribute to the protection of wetlands for open space and habitat preservation in the watershed.

. Contribute to the protection of spawning areas for the rainbow smelt in the lower reaches of Town Brook.

PLANNING CONSTRAINTS

Town Brook is a small urban watershed, and as such some of the flooding in the watershed is classified as an urban drainage problem rather than a flood control problem. These areas have been identified and are being addressed at the State and local levels. Therefore, any plan proposed by this study should complement this local effort.

The success of the smelt spawning is dependent on several uncontrollable factors in addition to the availability of spawning areas. Disease has impacted the smelt population in past years and water quality is a continuing concern. Water quality requirements are established in programs administered by appropriate Federal and State agencies. Therefore, while this study attempts to address this resource there are many factors which have more influence on the future of smelt in Town Brook.

FORMULATION AND ANALYSIS OF ALTERNATIVE PLANS

Various measures were examined to determine how well they met the objectives of providing flood protection. These alternatives were investigated to a sufficient degree to determine their economic and engineering feasibility, the environmental and other impacts resulting from their implementation, and their acceptance by the public. This section describes the alternatives and plans that were investigated and the iterative process used to evaluate and screen them.

PLAN FORMULATION RATIONALE

Management measures to address flooding and flood damages fall into five general categories and accomplish the following: reduce flooding, minimize damages from flooding, control development in the flood plain, accept damages, and mitigate impacts from damages accepted. The five general approaches and more specific plans are listed on the following page and are described in following sections.

Some measures have already been implemented to some degree or will be in the future by State and local entities. Measures are analyzed in terms of their effectiveness, feasibility, economics and impacts. Public acceptance is part of the assessment and evaluation. Subsequent sections are more specific in plan description, evaluation and comparison.

ALTERNATIVE APPROACHES TO FLOODING

I. REDUCE THE FLOODING

- A. Control the Land Runoff
  1. By Land Treatment
  2. By Conservation Measures
- B. Impound Floodwaters
  1. Modify Existing Reservoirs
  2. Construct New Reservoirs
  3. Optimize Operation of Existing Systems of Reservoirs
- C. Improve the Channel Capacity
  1. By Channel Enlargement
  2. By Removing Natural and Manmade Obstacles
- D. Confine the Flow - Levee and Floodwalls
- E. Bypass Flow to Avoid Damage Area - Tunnels

II. MINIMIZE DAMAGES FROM FLOODING

- A. Flood Proofing
- B. Forecast, Warn and Evacuate

III. CONTROL DEVELOPMENT IN THE FLOOD PLAIN

- A. Regulate Land Use
- B. Directly Acquire Flood-Prone Land
  1. By Acquisition of Development Rights
  2. By Acquisition, With Flood Damage Reduction as Primary Objective
  3. By Permanent Evacuation and Urban Renewal

IV. ACCEPT THE DAMAGE

V. MITIGATE SUFFERING FROM DAMAGE ACCEPTED

- A. Insure
  1. By Voluntary Subsidized Programs (Flood Insurance Program)
     a. Emergency Program
     b. Regular Program
  2. By Voluntary Nonsubsidized Program (Not Feasible)
  3. By Mandatory Subsidized Program
  4. By Mandatory Nonsubsidized Program
- B. Assist in Emergencies (Rescue and Aid)

VI. COMBINATIONS OF MEASURES

CORPS PROJECTS AND PLANS OF OTHERS

There are no other Corps projects in the Town Brook watershed. There are, however, State and local projects being planned and constructed which impact the water resources of Town Brook (see Figure 4).

In Quincy the following features are being planned or constructed as part of the Massachusetts Bay Transit Authority (MBTA) and highway transportation system projects:

1. A new culvert with added capacity under Route 3.

2. A relief conduit built in conjunction with the new highway off ramp and the Bergin Parkway.

Local drainage projects are planned in the Brook Road area and the Revere Road area.

In Braintree, plans are to increase the size of culverts under road crossings and through a reach of underground culvert. These projects would transmit floodflows for the 100-year flood without overtopping roads.

The city of Quincy and the town of Braintree are currently in the regular flood insurance program. In Quincy, which receives most of the flood damage in the watershed, an estimated 300 properties are insured against floods. Probably a majority of the flood-prone properties are covered, an unusually high response that might be attributed to the repeated flooding in the watershed over the last few years.

MEASURES TO REDUCE THE FLOODING

Control Land Runoff

Land Treatment - There are two distinct areas in the Town Brook watershed; the generally undeveloped upper reaches and the heavily urbanized lower reaches. There is no potential to reduce runoff through land treatment measures. The upstream portion of the watershed is located in the Blue Hills

Reservation. This area will be maintained in its present undeveloped state and no further increase or reduction in runoff should be expected. Therefore, the goal of any land treatment measures will be to protect against erosion rather than to reduce flooding. The urbanized lower watershed has very limited potential for reducing runoff rates by land treatment measures. Therefore, these measures were not considered further in detailed flood reduction plans.

Wetland Protection- Wetlands in the watershed, especially those that could have an effect on flooding are limited in number and extent. One example is the wetland between Route 3 and Center Street which is too small to significantly affect downstream flooding. Such wetlands are protected by State legislation and regulations and no further attention was deemed necessary.

Impound Floodwaters

There is one existing reservoir in the watershed, the Old Quincy Reservoir located in Braintree. It was constructed in 1886 by the city of Quincy for public water supply but this use has since been abandoned. It is now used to supply industrial water to the General Dynamics shipyard.

Alternative methods of providing flood control at this reservoir were studied. Raising the dam to provide additional storage was considered. However, the site already is developed to nearly its physical limits and very little storage could be added. Adjacent residents strongly opposed the concept and this approach was abandoned.

The existing reservoir, however, has shortcomings which cause flooding problems to adjacent school and residential properties. Inadequate outlet works could also jeopardize the safety of the dam and the benefits of any flood control project proposed downstream.

During the 1955 and 1968 floods, floodwaters overflowed the left shoreline onto Lakeside Drive. This study investigated the proposal to construct a low level (maximum height of 4 feet) dike along the left shoreline to stop this local flooding. A new emergency spillway with the capacity to pass the Standard Project Flood was investigated.

The city of Quincy has attempted to provide some flood control by maintaining the reservoir in a drawn-down condition since the 1968 overflow. This is done through regular inspections and by manually adjusting the outlet controls. The procedure has been successful although water levels sometimes fluctuate by several feet. A new outlet control was considered to insure that storage will be available when needed.

Two small flood pools were considered as an additional means of reducing downstream flows. They were sited to provide floodwater storage and to delay and reduce peak flows from their tributary areas. One would check the runoff from part of the parking area around the shopping mall on Route 128. The drainage area controlled and the flood storage available are relatively small, and this flood pool would have no measurable effect on peak discharges in Town

Brook. The other site considered would be part of the wetland located between Route 3 and Centre Street. Currently bounded by roads and railroad embankments, this wetland already provides natural flood storage; and its effectiveness cannot be substantially increased.

Improve Channel Capacity

Throughout the years, Town Brook has been modified and encroached upon until at present its capacity cannot handle the increased runoff. This problem has been compounded by upstream development and resulting increases in flows. Local interests have been able to address this problem in portions of the flood plain, especially through planned relief conduits in conjunction with new highway construction. An inadequate culvert in the reach from the new MBTA tracks through the Quincy central business district and then downstream to the Town River will continue to be a major restriction.

Relief Conduit

Increasing the channel capacity to handle 100-year flows was considered. Such a project would include constructing a twin 8 foot x 8.5 foot box culvert through downtown Quincy.

Under existing conditions, the need to increase channel size through the downtown area requires going under the new MBTA tracks without disrupting service, doing work under and around buildings, and relocating utilities and at least one building, disrupting major city roads, and excavating the salt marsh. The impacts could be lessened by combining the work with a planned urban renewal project that includes a new connector road through the business district.

Levees and Floodwalls

The underground nature of Town Brook throughout much of its course makes floodwall measures inappropriate and ineffective. Therefore, they were not considered in this study.

Bypass Flows - Tunnels

The concept of constructing a tunnel to bypass floodflows around and through damage areas was studied. Alternative tunnel alignments studied were tunnel inlets at two locations and tunnel outlets at several locations (see appendix B) in Town River and Town River Bay. Each plan would consist of an entrance structure and vertical shaft leading to an underground tunnel and ending in a vertical exit shaft and outlet structure. Tunnel diameters of 8, 12, and 15 feet were considered.

MEASURES TO MINIMIZE DAMAGES FROM FLOODING

Two measures to minimize flood damages were investigated: flood proofing and flood forecasting, warning and emergency evacuation.

Floodproofing

Floodproofing, a nonstructural measure, would reduce flood damages to individual properties. The level of flood protection would vary depending on flood stages, type of building and applicable measures.

Residential - In the residential sector, basement flooding depths range up to 5 feet. Basements are generally granite block construction and, though very solid, are not waterproof. Through total reconstruction of the basement a watertight condition could be achieved but this would be too expensive and was considered impractical. A second approach was taken to allow water to enter the basement but to protect high value equipment (i.e., furnace) through constructing a utility cell. For depths of 3 feet or less in the basement an interior waterproof wall was considered. This approach allowed damages to continue to other goods in the basement but at a smaller loss than at present.

Commercial/Industrial - In the industrial/commercial sector the types of building were more varied. For industrial buildings with block construction on a concrete slab, blocking openings (doors, windows) was analyzed and this proved to be effective.

Dikes around individual or groups of properties were evaluated. These dikes are applicable to all types of properties: residential, commercial and industrial. It was assumed they could be effective for up to 3 feet of flooding.

Flood Warning and Temporary Evacuation

Flood stages rise quickly from runoff in urban areas, and flood forecasting, warning and emergency evacuation would help protect flood plain residents but would not reduce property damages. These measures are contained in existing Civil Defense and emergency programs, however, the possibility of improving on present plans was considered. An improved plan could be implemented within a short time by non-Federal interests at a minimal cost.

CONTROL DEVELOPMENT IN THE FLOOD PLAIN

Regulate Land Use

The flood plain was studied with the view of applying land use control measures. This urban area of the flood plain is almost fully developed and very little open land exists however, and many land use regulation measures commonly used are already part of State and local policy. Wetland areas are regulated under State legislation. Subdivision regulations, zoning, and so forth are within the authority of the city of Quincy and the town of Braintree. Although this study will not address regulatory measures, should a permanent plan be implemented, non-Federal interests must agree to enforce regulations to prevent obstruction or encroachment on channels that would reduce their flood carrying capacity. Non-Federal interests are also required to enforce regulations which will minimize damages to future development in the flood plain.

Directly Acquire Flood Prone Land

The acquisition of flood plain land in Town Brook watershed normally requires the purchase of residences or businesses since the flood plain is nearly fully developed. This situation makes this measure costly and disruptive and acquisition was dropped in favor of less severe measures. The city of Quincy is currently developing plans for urban renewal in the business district. The plans are still in the concept stage and while some razing of buildings may be necessary, much of the new development is envisioned to occur in present parking areas. Developers and city officials are cognizant of the flood hazard.

ACCEPT THE DAMAGE

Acceptance of the flood damage would not meet the objectives of this study. The "without project condition" already lists the regular flood insurance program and local drainage efforts as measures that the city of Quincy and the town of Braintree have implemented to reduce or alleviate flood damages. The public is not willing to accept flood damges of about $2.1 million annually or the threat of recurring floods.

MITIGATE SUFFERING FROM DAMAGE ACCEPTED

Flood Insurance

Both the town of Braintree and the city of Quincy are enrolled in the regular flood insurance program. Estimates of level of participation in the program indicate that in Quincy a significant number of policies (950) have been taken out in the entire city. The State and local officials could expand the education program for flood plain properties.

ANALYSIS OF PLANS CONSIDERED IN PRELIMINARY PLANNING

Description of Plans

Measures which passed initial iterations are combined into plans for further evaluation. Three basic plans were formulated.

1. A plan centering around twin 8 x 8-1/2 foot relief conduits through downtown Quincy with channel work in the Town River salt marsh and culverts under the Southern Artery to convey floodwaters to Town River Bay without inducing flood damages.

2. A relief tunnel plan to reduce flooding with a deep rock tunnel bypassing floodflows under the downtown business district. Several alternative inlet and outlet locations were analyzed.

3. A nonstructural plan to reduce flood damages through floodproofing and a flood warning system.

The above plans address the primary flooding problems in the watershed. Other measures retained for evaluation were the Old Quincy Reservoir improvements and easements on the Town River salt marsh. These measures were valuable or essential additions to the three basic plans.

Comparative Assessment and Evaluation of Plans

Relief Conduit - The relief conduit through the downtown business district of Quincy was analyzed at a sufficient level of detail to determine costs and impacts. The project provides positive net economic benefits but under existing conditions this alternative is unacceptably disruptive to business activity and transportation in Quincy. Also channel enlargement through the Town River salt marsh would be required and would in effect destroy the wetland. Farther downstream at the Southern Artery, installation of new culverts would disrupt traffic, require the relocation of one business and eliminate the remains of a lock which was part of the former Town River Canal. Once installed, the presence and operation of the relief conduit could interfere with rainbow smelt spawning runs. The cost of the relief conduit would be about $20 million.

Relief Tunnel - Alternative tunnel alignments and sizes were studied to evaluate benefits, costs, and impacts

Alternative Inlets - The first tunnel entrance location would be located adjacent to Town Brook just upstream of the MBTA tracks adjacent to School Street. This alternative conforms well with the present and planned drainage system for Town Brook and flood plain areas. An alternative tunnel entrance site located to the south near the intersection of Water Street and Quincy Avenue was considered. This entrance would require a shorter tunnel, but major modifications to local drainage works and a relief culvert connector to the tunnel would be necessary.

Alternative Outlets - Tunnel outlets were considered at an array of locations (see appendix B) along the Town River and also out in Town River Bay. A tunnel outlet in the Town River marsh just downstream from Elm Street (option 2) proved to be the shortest and least expensive alignment, but would cause environmental and social problems. It would entail channel excavation and destruction of the salt marsh, and impact an adjacent residential area and convalescent home.

The tunnel outlet at the lower end of the wetland (option 1) eliminates the unfavorable impacts just mentioned. However, the cost of increased tunnel length is about $1.7 million as indicated in Table F-3 of appendix F. Both of these alternatives require larger culverts under the Southern Artery and under a supermarket parking lot. Construction of the culverts would take approximately 12 months and would disrupt traffic and affect the supermarket. Placing the tunnel outlet at the lower end of the wetland would require the use of a portion of an adjacent city playground/ballfield area for a maximum of two years during construction of the tunnel and outlet structure. Other impacts include the taking of flowage easements in the wetland to insure that there is no encroachment on the required flow area. This would have the coincident benefit of preserving this salt marsh in its present state. On the east (downstream) side of the Southern Artery easements are also required to insure that sufficient channel width is maintained.

A tunnel outlet extended out to Town River Bay (option 3) was considered as having less environmental impact. It could be located east of the Southern Artery and across the bay on Quincy city land. This would eliminate the need for crossing the Southern Artery and supermarket parking lot. The disruption during construction would be placed instead on the city public works storage area.

Alternative Capacity - The study evaluated 8, 12, and 15-foot diameter tunnels. The 15-foot tunnel was sized allowing for the capacity to carry the Standard Project Flood (SPF). The tunnel size showed positive net benefits, but is sized above the discharge capacity of the upstream drainage system. Therefore, the full capacity would not be used.

The 12-foot tunnel has a capacity approximately equal to the incoming drainage system. These flows have about a one percent chance of occurrence. Preliminary analysis produced results that showed that further analysis of this alternative was warranted.

The 8-foot tunnels also showed positive net benefits but did not have the physical capacity to handle all in-coming flows from Town Brook and upstream drainage improvements.

A maximization analysis was performed to determine economically the most efficient tunnel size. The evaluation determined that the maximum net benefits occur with a 10.7-foot diameter tunnel. Details of this analysis are shown in appendix I.

Nonstructural Plan - With the generally low velocity, low stage flooding that affects the Town Brook flood plain, floodproofing measures can be applied to structures to reduce damages. Types of measures that seem most applicable are blocking openings and installing shields, ring walls and utility cells. In many of the residential properties and business district stores it will not be economically feasible to keep water out of basements, so flooding will continue but with a reduction in damages.

For all floodproofing measures consideed, unprotected portions of properties, and grounds and outside equipment would still be vulnerable to flooding, cleanup operations would still be required, and loss of business would continue. A more effective flood warning and emergency evacuation plan is needed in conjunction with any plan centered around floodproofing. Flooding depths of several feet in urban areas could leave people stranded or create a safety hazard. Because of the continuing flooding and the safety hazard, the people in the flood plain oppose floodproofing as a solution to their flood problems.

A flood forecasting and warning plan is recommended as part of the plan to prepare for emergency evacuation.

Old Quincy Reservoir - The improvements at the reservoir would insure its structural and operational integrity for flood control. The storage at the reservoir is adequate to provide either complete control or appreciable

modification of all floods from the contributing watershed up to the magnitude of the 1955 flood of record.

Local interests reacted favorably to the measures proposed at the reservoir. They add to the safety of the dam and eliminate the flooding caused by the overflows and were retained for further study.

CONCLUSIONS (SCREENING OF PRELIMINARY PLANS)

Based on plan formulation and evaluations the following conclusions were reached on each of the plans.

Relief Conduit - This plan would provide the necessary flood protection to downtown Quincy; however, it would be unacceptably disruptive to business activity, transportation and environmental values. Therefore, it was dropped from further consideration.

Relief Tunnel - Analysis of economics and impacts of a relief tunnel plan indicate that planning objectives could be addressed while retaining positive net benefits and providing plan features to avoid serious impacts. Therefore this plan would be retained for detailed analysis. Concerning the selection of the inlet, the alternative inlet adjacent to School Street and Town Brook was less disruptive and conformed with present and future drainage plans; and was therefore selected. The outlet at the downstream reach of the Town River marsh was the most acceptable in terms of costs and environmental impacts.

Of the three tunnel sizes analyzed, (8, 12 and 15-foot) the 12-foot diameter tunnel was selected for detailed studies. All three showed positive economics. However, the 8-foot tunnel was sized below the capacity of incoming flows and would result in high residual damages. In comparison, the 15-foot tunnel was sized to handle SPF flows, but because of the capacity of the incoming drainage system these flows would never reach the tunnel. Therefore, SPF protection in the flood plain would not be achieved. The 12-foot tunnel represented the size that most closely matched incoming flows and provided a 100-year level of flood protection.

Nonstructural Plan - This plan does not reduce flooding in the flood plain areas but does provide a means of reducing flood damages. Major drawbacks appear to be a lack of public support for this approach and also the high level (80 percent) of residual damages after plan implementation. However, because of the favorable economics and the desire for an alternate approach, this plan was retained for detailed study.

Old Quincy Reservoir - The improvement measures would be an important ingredient to insure that flooding is reduced in the watershed. This is especially important to the relief tunnel plan which addresses damages by reducing flooding. Two potential problems prevail. The overflows around the dam cause flood damages to residential areas near the dam. More serious is the threat of dam failure. Such an event would cause catastrophic problems in Braintree upstream of Route 3. The discharges through the Route 3 culverts would exceed the capacity of the downstream relief conduit and tunnel system and would essentially negate the benefits of these measures if such an event occurred. Because of the potential impact, the reservoir improvements were made part of the relief tunnel plan.

ASSESSMENT AND EVALUATION OF DETAILED PLANS

Two alternative plans will be analyzed in the final system of accounts. These two are:

1. A relief tunnel plan with improvements at Old Quincy Reservoir.

2. A nonstructural plan.

These two plans will be evaluated against a without project condition that assumes the completion of all local drainage works throughout Braintree and Quincy.

PLAN A - RELIEF TUNNEL

Description

The plan consists of the tunnel alternative supplemented by improvements at the reservoir. The main features of this plan are:

1. A 12-foot diameter, 4060-foot long, concrete lined tunnel constructed in rock 130+ feet below ground.

2. The tunnel inlet would be located just off School Street adjacent to the "Red Line" of the MBTA and the proposed Bergin Parkway. The inlet structure would be about 40-feet x 50-feet in size and will accept flows from Town Brook and from the proposed relief drainage conduits along Bergin Parkway. The structure will be designed to act as a sediment trap and will have access provisions for cleanout and maintenance.

3. Normal flows would be allowed to pass in the present Town Brook channel through downtown Quincy and the lower reaches of the stream. Any normal flow--about 100 cfs is expected--can be accommodated.

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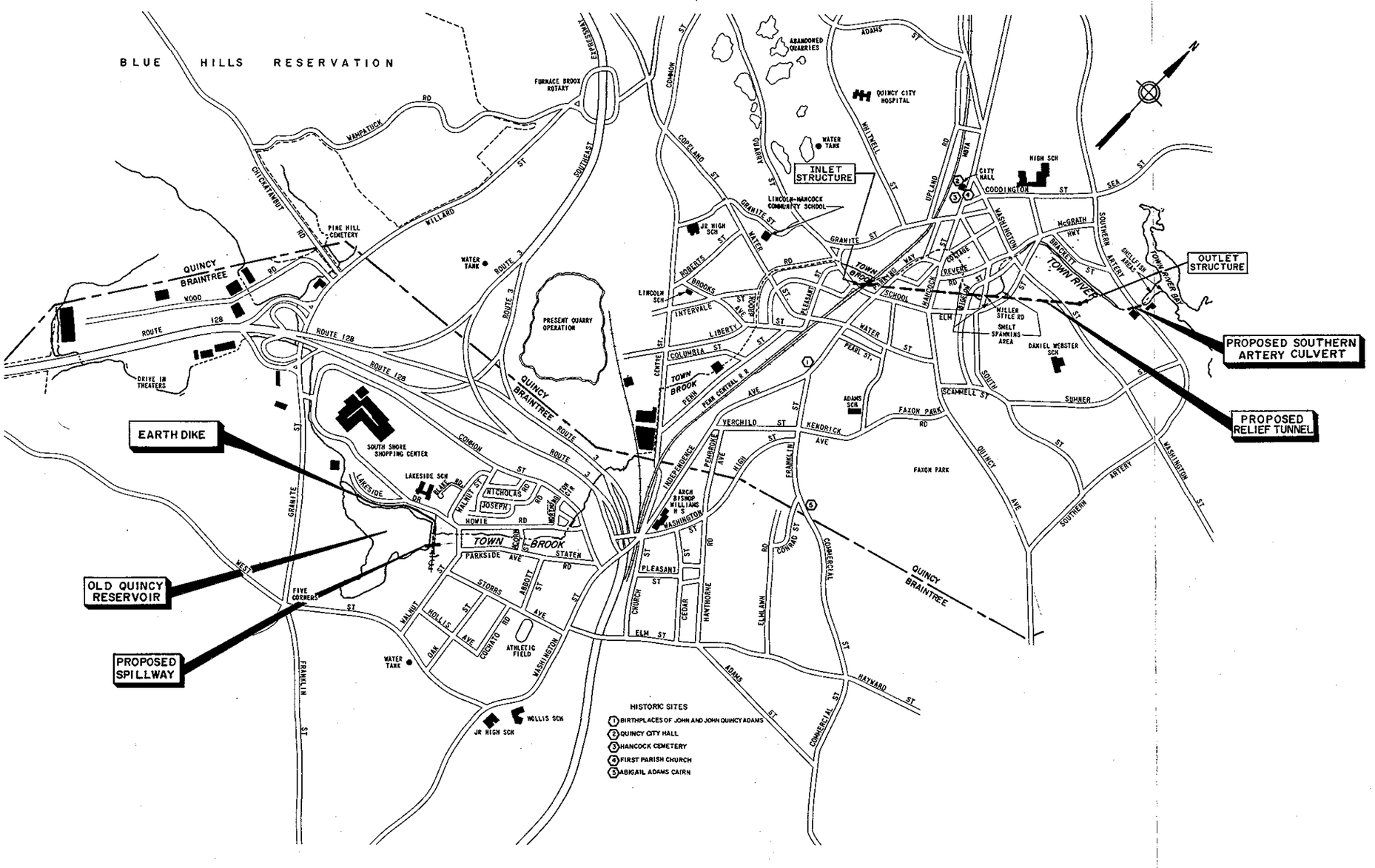

GRAPHIC SCALES

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TOWN BROOK LOCAL PROTECTION
QUINCY AND BRAINTREE
MASSACHUSETTS

TUNNEL PLAN

GENERAL PLAN

NEW ENGLAND DIVISION
CORPS OF ENGINEERS
SEPTEMBER, 1980

FIGURE 5

4. The tunnel outlet is planned at the lower reach of Town River just upstream of the Southern Artery. The outlet structure would be constructed adjacent to the wetland. Excavation would be planned to permit exit of the tunnel outflows into the wetland area. No excavation is necessary in the wetland itself.

5. Flooding easements would be obtained in the wetland to insure that encroachment on the wetland area does not take place since the total present flow area is needed to safely pass floodflows out of the wetland.

6. New culverts would be constructed under the Southern Artery and adjacent supermarket parking lot. In conjunction with this, the left bank of Town River downstream of the Southern Artery would have to be widened to provide sufficient channel capacity. Flap gates on the downstream end of the culverts would be installed to preserve present conditions in the Town River wetland and lower reaches of Town Brook during high tide events.

7. Modifications at Old Quincy Reservoir dam would include a new spillway and outlet structure, flattening of the downstream slope, repairs to the stone protection on the upstream slope and regrading the top of the dam to elevation +85.

8. Control of the Old Quincy Reservoir to maintain normal water level at approximately elevation 73.4 feet which provides storage for flood control.

9. A dike along the north shore of the Old Quincy Reservoir to prevent overflows from the reservoir into Lakeside Drive.

10. The enlarged emergency spillway at the Old Quincy Reservoir would provide sufficient capacity to pass the standard project flood with freeboard and the probable maximum flood with the pool level at the top of dam.

11. A flood warning and evacuation plan to protect against infrequent storms which are very severe in nature. This is needed as a storm of rare intensity could produce flows in excess of the design capacity of the project. The plan would have three major components; a warning system, warning dissemination process, and an evacuation plan. See Appendix F for more detail.

A practical flood warning plan for Town Brook would be composed of an automatic flood alarm system and manual observations. Potential locations for the alarms would be at the Old Quincy Reservoir, at the tunnel entrance, and at Revere Road or the storm gage. These alarms would be supplemented by observers to monitor water level along the brook.

The dissemination of the flood warning must be done to reach the entire flood plain. For the Town Brook area, a combination of radio announcements, door-to-door warnings, and telephone warnings would be used. The warning would describe the appropriate course of action for the affected individuals or structures. A plan would be developed to identify evacuation routes and shelters.

Because of the level of protection provided by other components of the plan, the use of flood warnings in Town Brook would be infrequent. This would require extra attention to be sure that procedures are kept current and equipment maintained.

12. Measures to maintain the water quality would be designed into the tunnel so that discharges are equal to or better than the quality of streamflow expected under normal conditions. The procedures being considered include flushing the tunnel, injection of oxygen or pumping the tunnel dry. Specific measures and operation procedures would evolve throughout the design process as more factors are analyzed.

Impact Assessment

The major impact of Plan A would be a reduction in flood damages of $1.97 million annually. This benefit would be realized at a cost of $1.5 million annually resulting in annual net benefits of about one half million dollars. The benefit to cost ratio for this plan is 1.34 to 1.

In Braintree, the work at the reservoir would eliminate the potential for overflow into Lakeside Drive and therefore eliminate this flooding. By providing the outlet works needed to maintain a drawdown level in the reservoir, flood storage would be provided for about 3 inches of runoff. This storage is adequate to provide either complete control or appreciable modification of all floods from the contributing watershed, up to the magnitude of the flood of record. Flows above this level would pass under control over the spillway. These measures at the reservoir would eliminate the potential for dam failure. Downstream of the reservoir the installation of planned new culverts by the town and State would keep water from overtopping road crossings and eliminate flood damage to all but a few properties.

These reservoir measures would have only minor environmental impact. The lake level operation schedule would improve that presently strived for through a manual trial and error procedure. Therefore, no changes in lake level are anticipated. On the north shore where the dike is planned, one cluster of trees may have to be removed. With a maximum height of 4 feet the dike will be visible, but no views from Lakeside Drive would be impaired.

The relief tunnel would be constructed underground and would therefore require subsurface easements from affected properties. At the inlet a 40-foot x 50-foot inlet structure would be required to receive floodflows. Normal streamflows would continue to pass through the present Town Brook Channel. The outlet structure is located at the lower end of the Town River wetland just upstream from the Southern Artery and will increase flow rates into the wetland from 750 cfs to 1,500 cfs for the 100-year storm.

The tunnel provides the capacity to pass the 100-year floodflows and would provide this level of protection from Town Brook flooding. The actual flood protection that is received by all flood prone areas is dependent not only on the tunnel but also on the local drainage system which removes local inflows.

The relief tunnel would be designed so that it would have no deleterious effects on water quality. When operational the tunnel would have the potential to release anoxic waters into Town River. This potential would continue to be assessed during design and features included to avoid water degradation.

Construction of the tunnel carries with it many impacts typical at construction projects: traffic, equipment noise, and local disruption. Much of the work is underground though and would be done with little observable impact. The tunnel will be constructed from the outlet end and in this area the impact will last 1-1/2 to 2 years. A total of about 25,000 cubic yards (cy) of rock will have to be excavated. The material will be hauled away by trucks at a rate of about one truck per hour.

A disposal site for the rock has not yet been evaluated. This will be done during design studies. Potential methods of disposal are commercial use as fill or aggregate or use by the city of Quincy, which has expressed interest in taking the rock for its public works projects. Approximately 3,500 cubic yards (15 percent of the total) will be used in fill or stone protection at the Old Quincy Reservoir and connector channel. Excess materials may also be disposed of in abandoned quarries nearby or at locations acceptable to local officials, which will not adversely affect the environment.

The installation of box culverts under the Southern Artery would require disruption of traffic. By limiting construction to half of the highway at one time, nearly full traffic flow can be maintained through three lanes.

Construction at the outlet will also require about 3 acres of work area for equipment and material storage. This would require use of a city recreation area adjacent to Town River.

The construction of the box culverts through the supermarket parking lot would cause a one-half year disruption at the market.

Across the Southern Artery there is a 500-foot reach of Town River, where the left bank would have to be excavated to provide a minimum 40-foot width. Just downstream of the Southern Artery are the remains of an old rock dam and stonewall that were part of the Town Brook Canal.

Mitigation Requirements

Potential areas of mitigation include measures to prevent water quality problems from developing in the tunnel, providing supplemental parking for the supermarket at the Southern Artery and proper handling of the remains of a lock basin which was part of the former Town Brook Canal.

Water Quality Measures

The proposed relief tunnel would be designed to operate during floodflows. During periods of normal flow, water would pass down Town Brook and not enter the tunnel. The water in the tunnel would remain standing until the next high flow period. If the tunnel's contents stay aerobic, the water

discharged would be the same as inflows and would cause no problem. If the water turns anaerobic, however, odors, hydrogen sulfide, and methane gas could be produced and iron and manganese converted to soluble forms. The role of the mitigation measures would be to prevent water quality problems from developing.

Potential water quality problems are being addressed by incorporating into the tunnel design a water circulation system. The system is designed to work on the natural fluctuation of the tides. See Appendix D for details.

The Corps would conduct future studies related to water quality aspects of the diversion tunnel. Potential problems related to long term storage of water, oxygen depletion, saltwater intrusion, gas generation, etc., would be addressed along with evaluation of impacts downstream in Town River due to the discharge of water from the tunnel. Measures, both structural and nonstructural, to alleviate water quality problems in the tunnel and downstream would be investigated further, and a recommended plan of action formulated. Laboratory studies of long term storage of Town Brook and seawater would be performed to simulate tunnel conditions and assist in determining the potential for water quality degradation and arrive at a system design.

Supermarket Parking

The construction of the box culverts under the supermarket parking lot could be a disruption to the market. Arrangements would be made to install the culverts with the idea of minimizing disruption. The construction will be done in stages in conjunction with crossing the Southern Artery. This would keep access open to the main parking area in front of the store. The use of precast box culvert sections would also be considered to reduce construction time. A third feature would be the construction of a temporary parking area on the west side of the store. This would permit the store's customers to park away from the construction. Playground equipment in the area could be accommodated along the edge of the wetland or moved to another section of this city recreation area. Following construction, the market's parking area would be resurfaced and the temporary parking area returned to recreation use.

Town Brook Canal

The proposed project area includes a ruined lock basin of the Quincy Canal (c. 1824). This is a timber and stone structure in a deteriorated condition. It is anticipated that the lock structure could be impacted by channel widening in this area. Therefore, in the next stage of project planning, the Corps would seek a determination of eligibility for the National Register of Historic Places for this structure. If the lock is determined eligible, plans would then be undertaken for mitigation of the project impact upon the lock remains.

Implementation Responsibilities

Cost Allocation - The measures proposed for this project are single purpose flood control and as such all costs are allocated to flood control.

Cost Apportionment - The apportionment of costs between Federal and non-Federal interests are computed to reflect two policies:

1. The existing cost sharing legislation, and

2. The President's cost sharing policy.

Existing Cost Sharing Legislation - Sharing of costs between Federal and non-Federal interest for the construction, operation, and maintenance of the Town Brook flood control project is based on the requirements established as Federal policy for "local protection" improvements. Under this policy, the Federal government would be responsible for all flood control construction costs and non-Federal interests would be required to provide, without cost to the United States, all lands, easements, and rights-of-way necessary for the construction and operation of the local protection project. Non-Federal interests would also bear the cost of operating and maintaining project features after construction in accordance with Federal requirements.

President's Cost Sharing Policy - This policy requires that the Commonwealth of Massachusetts contribute 5 percent of project construction costs for flood control. Construction costs are defined as all costs apportioned to Federal and non-Federal interests for implementation of the Federal project.

In addition, there is a 20 percent non-Federal contribution for structural and nonstructural flood damage reduction measures. The current procedure still requires that non-Federal interests will acquire lands, easements, and right-of-way for the project with the Federal government reimbursing the non-Federal interests for any amount expended in excess of the 20 percent.

The Federal and non-Federal share of the project first costs for the two cost sharing policies follow.

	Existing Legislation	President's Policy
Federal	$20,575,000	$15,562,000
Non-Federal		
State		1,038,000
Sponsors	175,000	4,150,000
Total Non-Federal	175,000	5,188,000
Total Project First Cost	$20,750,000	$20,750,000

Federal Responsibilities - The Federal government would design and prepare detailed plans and construct the project, after Congressional authorization and funding and after receipt of the non-Federal share of the investment.

Non-Federal Responsibilities - Letters of assurance will be required from the Commonwealth of Massachusetts, city of Quincy, and town of Braintree

indicating their willingness and ability to participate in the project and to fulfill the conditions of local cooperation. In addition to furnishing project lands and easements, local interests would be responsible for utility relocations required by the plan, for the reconstruction of certain culverts and pavements, for damages resulting from the construction, and for preventing encroachments on the improved channels and ponding areas.

Public Views

Throughout the study, public views have been incorporated into the plan formulation process. This input has been received from Federal and non-Federal agencies as well as the public in general (see Appendix C for details).

Views of Federal Agencies - The U.S. Fish and Wildlife Service has been directly involved in the study. Throughout the plan formulation process the Service has stressed the importance of protecting the natural resources of the watershed, including the smelt spawning area, the salt marsh and other wetlands. This tunnel plan, as formulated, would not adversely affect these resources and urges their protection.

Views of Non-Federal Agencies - The city of Quincy and the town of Braintree have been major supporters of this study, first by seeking assistance in resolving flooding problems and then in the plan formulation process. Both municipalities support the concept of a tunnel plan to alleviate flooding problems.

The Commonwealth of Massachusetts has been directly involved in the study. Through the Metropolitan District Commission (MDC) the Commonwealth has worked directly in supporting the study financially and through active participation. Commonwealth agencies have been closely involved in the Town Brook study through participation in the planning and construction of major transportation facilities and sewer projects. Close coordination has been maintained throughout the study and the Commonwealth supports the concept of a tunnel plan to reduce flood damages.

Individual citizens and residents have supported the tunnel concept to alleviate flood damages. They feel strongly that living conditions in the flood plain would improve after flood control is provided.

PLAN B - NONSTRUCTURAL PLAN

Description

Reducing flood damages through nonstructural measures is done largely through floodproofing, a flood warning and evacuation plan, and use of storage in the existing Old Quincy Reservoir for flood control. The plans for the four major flood pool areas follow. Refer to appendix F for detailed analysis.

Brook Road Pool - There is a mixture of residential, commercial, and industrial properties in the area. The residential section contains about 100 single family homes which could have up to 6 feet of water in the basement. The two approaches most feasible to reduce damages to these homes were utility cells or ringwalls.

The utility cell is an 8-foot x 8-foot reinforced concrete cell with a watertight door (see figure 6). The cell would be constructed in the basement to protect the furnace, electric switchbox, gas and electric meters, and hot water heater. This type of structure was applied when flood inundation in the basement could be greater than 3 feet. When the anticipated flooding depth is less than 3 feet deep, the cell is reduced to an 8-foot x 8-foot reinforced waterproof concrete wall. Access is by steps rather than by door.

With the utility cell, damages to the property would not be eliminated, but the major utilities would be protected. Other items in the basement, and properties and grounds would continue to sustain damage.

In flood plain areas where homes are close together, protection could be obtained by construction of a reinforced concrete ringwall around clusters of homes. The proposed wall would be faced with brick veneer and would be provided with access openings and closures for each home. Sump pumps would be needed to drain interior areas.

There are also 26 industrial and commercial buildings in this area. Most of these properties are of block construction on a concrete slab. These properties can be floodproofed by waterproofing the block walls up to a height of 2 feet and preparing flood shields to block openings during flooding. Interior pumping capability must be provided to discharge seepage.

Shopping Center Pool - In the downtown business district of Quincy flooding is caused by backwater from Town Brook which is forced through underground drains and seepage during high flood stages. This is compounded by surface flooding because there is no outlet for local drainage.

About 60 area businesses are prone to flood damage. It is not feasible to keep floodwaters out of these basements. Flap gates installed on drainage pipes to prevent backup flow would not be effective because of unmapped drains and seepage flooding sources. Therefore, the primary floodproofing measure in this area is the use of utility cells to protect major utility investments. Businesses would have to rely on flood insurance to provide economic relief from flood damages.

Bigelow Street Pool - In the Bigelow Street pool there are about 30 residences, 4 commercial and 2 public buildings susceptible to flooding. Damages could be reduced by utility cells.

Braintree Pool - The major source of flooding here is overflow from Old Quincy Reservoir. Water overflows the north shore, flowing down through about 35 residential properties in the Lakeside Drive area. Most of the flow is shallow overland flooding with some velocity. Damage is largely confined to basements, which are concrete. Floodproofing measures to keep water out of basements should be feasible.

A flood warning and evacuation plan would be an essential part of the floodproofing plan for the Town Brook flood plain. The properties would be surrounded by floodwater and access would be difficult and restricted. The town of Braintree and the city of Quincy now have a basic warning and evacuation plan implemented through the fire and police departments and its Civil Defense operations.

Reservoir Operation - An important nonstructural measure in the upper basin is the continued use of the storage potential in the existing Old Quincy Reservoir to reduce the peak runoff rate from the upper 1000 acres of drainage area. This involves operating so as to maintain the normal pool level about 7-1/2 feet below the existing spillway crest elevation.

Flood Warning and Evacuation - An important part of Plan B would center around a flood warning and evacuation plan. The mechanics and operation of this plan would be about the same as spelled out for Plan A and Appendix F. Because of frequent flooding problems on Town Brook this could mean frequent use. This would help keep personnel familiar with Town Brook. However, care would be required to avoid overuse of the system for minor flooding, which could dilute the plan's effectiveness during more critical situations.

Impact Assessment

The major impact of this plan would be a reduction in flood damages of $367,000 annually. This benefit would be realized at a cost of $134,000 annually. The resultant benefit to cost ratio is 1.43 to 1. Since not all damages are eliminated, residual damage of $1.5 million per year would occur on the average.

The flooding would continue to occur so residents would need to be evacuated during each flood and cleanup will be required. Businesses would suffer disruptions and losses. With repeated flooding, properties would tend to deteriorate.

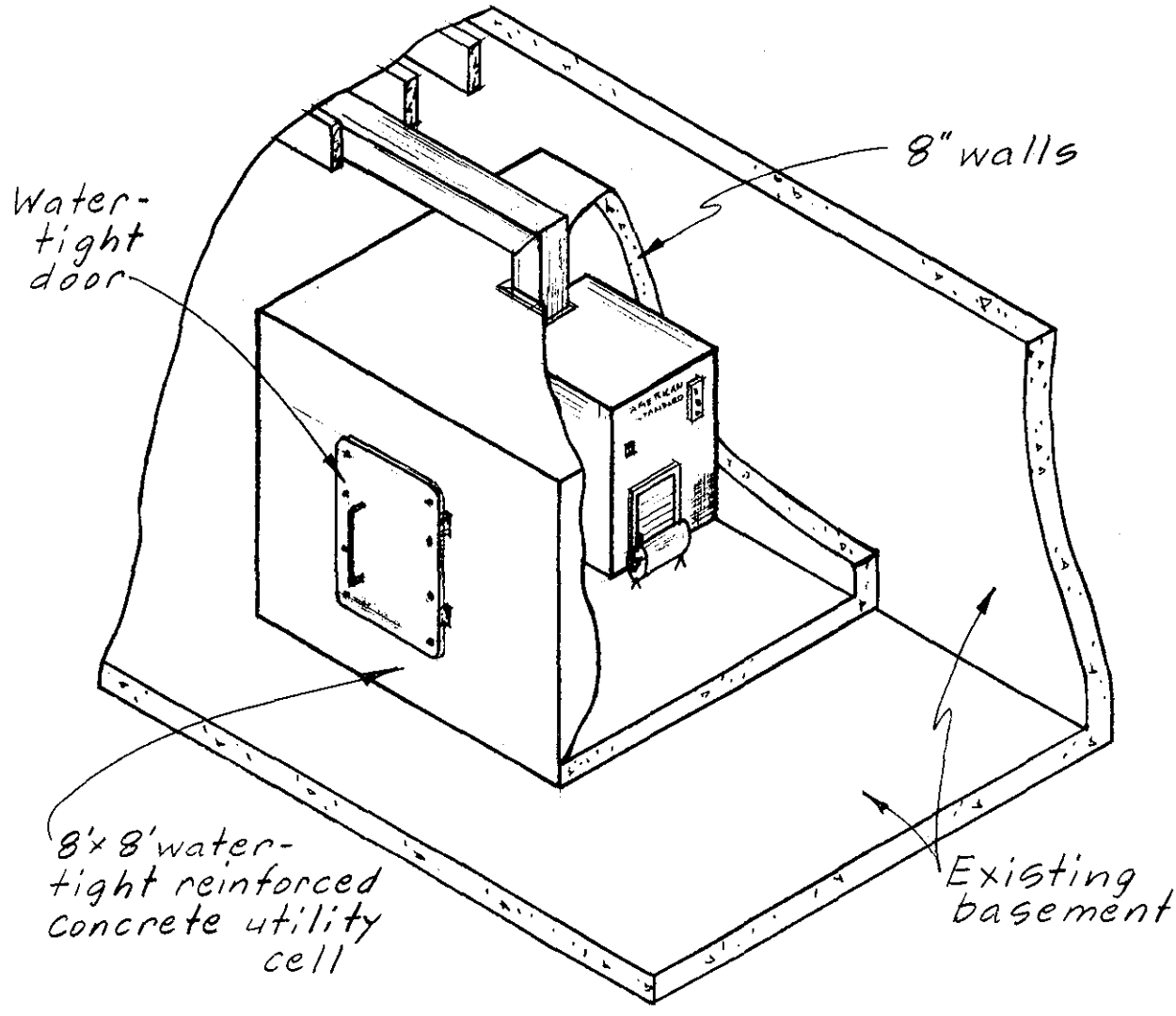


FIG. F6 UTILITY CELL WITH WATERTIGHT DOOR

There would be construction impacts during installation of utility cells and ringwalls. Construction equipment and procedures would result in an increase in noise, dust and traffic. This impact would occur within the residential and business areas being protected.

To realize the damage reduction potential of the floodproofing measures property owners would have to take an active role in maintaining and installing floodproofing components and heeding flood warnings. Without this cooperation the plan would be ineffective.

No major impacts are expected on the natural resources as a result of implementing the nonstructural plan.

Evaluation and Trade-Off Analysis

In a nonstructural plan to reduce damages along Town Brook, floodproofing measures are the most feasible approach. In general, flooding velocities and depths in the problem area were not of sufficient magnitude to warrant relocation of properties so relocation was not evaluated further as it would be more expensive and disruptive to the community. There is very little vacant land in the area to absorb relocated housing, businesses and new development. Therefore, any relocations would probably be a loss to the community. With the lack of vacant land there is also no possibility for zoning as an applicable measure.

A primary floodproofing measure is the utility cell located in the basement. An alternative which provides the same level of protection as a utility cell in the basement is the first floor utility room. The cost of the basement utility cell is slightly higher but is generally preferable to the added room since in many instances additional structural area is not available.

With the proposed utility cell, basements would continue to flood. Existing foundations cannot be made waterproof but they could be replaced with reinforced concrete foundations. However, these would be more costly and more disruptive than allowing water to enter the basements.

Mitigation Requirements

The nonstructural plan would not have an impact on resources that would require mitigation.

Implementation Responsibilities

Cost Allocation - All project costs are allocated to flood control purposes.

Cost Apportionment - As with the relief tunnel plan, the apportionment of costs are computed to reflect the existing cost sharing legislation and the President's cost sharing policy.

Existing Cost Sharing Legislation - Under this policy the Federal government would pick up 80 percent of the construction and lands rights costs for the nonstructural measures. Non-Federal interests would pick up 20 percent.

President's Cost Sharing Policy - The apportionment is the same as for the structural measures in the tunnel plan. The Commonwealth would be required to pay 5 percent of the costs and non-Federal interests would pay 20 percent.

The Federal and non-Federal cost for the two cost sharing policies follow.

	Existing Legislation	President's Policy
Federal	$2,103,000	$1,972,000
Non-Federal		
State	----	131,000
Sponsors	526,000	526,000
Total Non-Federal	526,000	657,000
Total Project First Cost	$2,629,000	$2,629,000

Federal Responsibilities - The Federal government would design and prepare detailed plans and construct the project, after Congressional authorization and funding and after receipt of the non-Federal share of the investment.

Non-Federal Responsibilities - Letters of assurance will be required from the Commonwealth of Massachusetts, city of Quincy, and town of Braintree indicating their willingness and ability to participate in the project and to fulfill the conditions of local cooperation. In addition to furnishing project lands and easements, local interests would be responsible for utility relocations required by the plan and for damages resulting from the construction.

Public Views

The majority of public expression received at public meetings, coordination meetings, and workshops favored the reduction of flooding in residential and business areas in the flood plain. Residents do not want to continue to live with the flooding because of its physical and economic impacts. Generally, they do not favor the concept of minimizing flood damages while letting flooding occur.

COMPARISON OF DETAILED PLANS

This section compares the two plans selected for detailed evaluation: the relief tunnel and reservoir improvement plan and the nonstructural plan described in the previous section, "Assessment and Evaluation of Detailed Plans." The comparison of the plans provides the basis for designating the NED plan and the EQ plan. Finally, the rationale for arriving at the selected plan is discussed.

COMPARISON OF DETAILED PLANS

Detailed plans are appraised by their ability to meet planning objectives and by their contributions to the System of Accounts, which is shown in the "Summary Comparison of Final Alternative Plans."

Level of Protection

The relief tunnel and reservoir plan (Plan A) reduces flood damages by reducing flooding, while the nonstructural plan (Plan B) prevents flood damages by physically protecting damageable property. The relief tunnel has the capacity to pass flows up to the 100-year flood. The flood plain would be reduced to a few remaining low areas. Flood damages would be reduced to those associated with minor clean up, pumping of basements, and so forth.

With Plan B, flooding would continue. Damages would be reduced through floodproofing measures. The level of protection afforded will vary depending on the type of measure used and the nature of the property. In the residential sector some homes can be fully protected by constructing ring walls around individual or groups of homes. Most residences, however, would continue to receive flood damages except to their utilities which can be protected by utility cells. In the business district, stores will also continue to receive basement flooding except that utility cells would be proposed to protect utilities. Industrial and commercial properties with sufficient structural integrity can be flood proofed with shields and walls. People in all flood plain areas will be evacuated during floods. All unprotected property will continue to be flood damaged.

Economic Efficiency

The economics of the relief tunnel plan are more favorable than the nonstructural plan. This is shown by the summary of costs and benefits as follows:

Item	Plan A Tunnel Plan	Plan B Nonstructural
Ave. Annual Benefits	$1,996,000	$365,000
Annual Costs	1,486,000	278,000
Net Benefits	510,000	87,000
BCR	1.34 to 1	1.43 to 1

Public Acceptance

During public meetings the citizens of Quincy and Braintree have expressed acceptance of the tunnel plan and reservoir improvement plan. They want to eliminate the flooding to their properties and feel that in accomplishing this, that their quality of life and property value will increase. In contrast the nonstructural plan will reduce flood damages, but flooding will continue to disrupt the residential and business areas in the flood plain. This is less acceptable to the public because only a portion of damages are prevented, evacuation during flooding will be required, and the full potential of the area cannot be realized as long as flooding continues.

Implementation

The proposed measures of the relief tunnel and reservoir improvement plan will be implemented through established procedures by the Corps of Engineers in cooperation with the Commonwealth of Massachusetts, the city of Quincy and the town of Braintree. The operation and maintenance of the plan measures would be performed by the local interests.

In comparison, implementation of the nonstructural plan will depend on the cooperation and approval of individual property owners. Where temporary flood shields are called for individual property owners will need to install the shields to prevent flood damages. Accurate flood warnings would be necessary to give flood plain residents and businesses the time required to prepare for flooding and evacuation. Continued effectiveness of the flood proofing measures would require an extensive public education program, and inspection and maintenance of individual properties.

In general, the implementation and the operation and maintenance procedures are more complex for the nonstructural plans than for the relief tunnel and reservoir improvement plan.

Effectiveness

Plan A would be more effective than Plan B, since it provides a greater level of flood damage reduction and prevents inundation of flood plain lands. Also, effective operation is built into the design of the measures and does not require active preparation as is the case for some of the flood proofing measures.

Completeness

Plan B is designed to be complete in itself. Installation of the measures will provide the designed level of protection. The relief tunnel is also complete in its ability to carry floodflows, although local entities must complete the planned drainage system for full protection to be realized. These local improvements are being designed and construction is scheduled to start in 1981.

Other Considerations

Plan B retains the status quo for stream flow in Town Brook. Therefore, there would be no impact on the smelt habitat or the salt marsh.

The relief tunnel would likewise have no effect on the smelt or the salt marsh. On the positive side, the purchase of easements or the wetland to provide adequate flow area would guarantee preservation of the marsh from encroachment.

Attaining the level of protection afforded by the tunnel and reservoir plan will cost $18.1 million more than the nonstructural plan. When broken down into its components, this means that there would be an additional Federal cost of $13.6 million and an additional local cost of $4.5 million based on the President's cost sharing policy.

RATIONALE FOR DESIGNATION OF THE NED PLAN

The NED plan maximizes net benefits while still meeting a range of specific evaluation criteria. With these as criteria the relief tunnel plan is designated as the NED plan. This plan has net benefits of $510,000 as compared to $121,000 for the nonstructural plan. This plan is also responsive to meeting planning objectives, acceptability, effectiveness, stability and other evaluation criteria.

RATIONALE FOR DESIGNATION OF THE EQ PLAN

The EQ plan was selected according to contributions of alternative plans to the components of the EQ objective. The relief tunnel and reservoir plan (Plan A) was designated as the EQ plan. This choice was based foremost on the preservation of the salt marsh, where easements would be purchased to insure adequate flow areas for tunnel discharge flows. The acquisition of this land is needed as an added precaution against further encroachment that would impinge on the hydraulic characteristics of the wetland. While the purchase is needed to insure proper functioning of the flood control measures, acquiring this land would also serve the purpose of preserving the marsh. Plan A could have negative impacts on the environmental objective, but, with further studies and mitigation measures the negative impacts will be neutralized or produce positive impacts. The issues in question are water quality, aquatic life and a historic site associated with the Town Brook Canal. Water circulation features to avoid water quality problems have been incorporated into the tunnel design and no adverse impacts are anticipated.

Plan A would also affect remnants of a lock associated with the former Town Brook Canal. The historical significance of this site has not been determined and resolution of this issue will be accomplished through further studies and coordination. The impact of the project can be mitigated through recording the existence and features of this site. The present situation is that the remains are deteriorating and eventually the site will be completely lost through the actions of natural forces. Without a formal documentation process there would likely be no record of the site for future reference. This record can be provided as part of this project.

While Plan A produces net positive impacts on the EQ objectives, Plan B produces no impact. The flood proofing and flood warning measures deal with individual properties and will neither benefit nor adversely affect the natural ecological system, the water quality or the historic sites.

RATIONALE FOR SELECTED PLAN

The selection of a recommended plan is based on public desires economic efficiency, environmental factors, and other evaluation criteria. Based on all these, Plan A is the selected plan. This plan produces maximum net economic benefits. It meets the objectives of reduction of flood damages through reducing flooding which is more acceptable to the public than simply preventing damages through flood proofing. The plan also provides positive contributions to the Environmental Quality Objective.

CONCLUSIONS

The Division Engineer of the New England Division, Corps of Engineers has reviewed and evaluated, in light of the overall public interest, the information contained in the environmental assessment and other documents concerning flooding in the town of Braintree and the city of Quincy. The views of other agencies, organizations and individuals on the environmental and other impacts of the selected plan for local flood protection were also considered. In addition, the Division Engineer has inspected the project area and participated in meetings with local officials, representatives of other agencies and organizations, landowners and other concerned members of the public.

The possible consequences of constructing the selected local protection project as well as each of the alternatives, were studied and evaluated for environmental effects, social well-being, engineering considerations and economic factors. Specific attention was given to alleviating flood damages and preserving the natural environment of the area.

It is Corps of Engineers policy to abide by the provisions of Executive Orders (E.O.) 11988 on Flood Plain Management and 11990 on Protection of Wetlands. The measures of the selected plans are not in conflict with these policies. Concerning E.O. 11988, the proposed plan would preserve the Town River coastal wetland through purchase or easements while having only a minor impact resulting from construction.

The proposed plan would not encourage any new development in flood hazard areas, since the flood plain is nearly fully developed at present. The flood protection could aid in planned economic revitalization and urban renewal projects, but these projects are scheduled whether or not there is a flood control project.

In accordance with the Principles and Standards for water resources investigations, a wide array of alternative measures for reducing flood damages were investigated. Through an iterative plan formulation process, two alternative plans evolved which warranted detailed evaluation.

The selected plan consists of a 4,000 foot long relief tunnel, enlarged box culverts under the Southern Artery, permanent easements on the Town River coastal wetland, and structural improvements of the Old Quincy Reservoir. The selected plan maximizes net benefits and is therefore the National Economic Development (NED) plan. It also makes positive contribution to the environment and is therefore the Environmental Quality (EQ) plan. This was chosen as the selected plan since it is the NED plan, EQ plan and also the most acceptable.

The second plan that was studied in detail was nonstructural, consisting of flood proofing, flood warning, temporary evacuation and continued use of storage in Old Quincy Reservoir for flood control. Flood proofing consisted of utility cells, ringwalls and blocking of openings. This plan showed positive net benefits overall but was not desirable since residual damages were high.

Engineering Considerations - The selected local protection plan would meet the flood protection needs of the area, satisfy the desires of local interests for improvement of the human environment and natural resources, and provide an economical solution consistent with sound engineering. The selected plan would provide a 100-year level of flood protection for major flood damages areas in the Town Brook watershed.

Environmental Considerations. Through successive iterations of the plan formulation and evaluation process, a plan was selected that would have minimum adverse environmental impacts. Potential adverse impacts could result from excavation of a portion of a possible historic site. These impacts will be mitigated if necessary or desirable.

Social Well-Being - The selected plan would eliminate flooding in about 175 acres of urban development. The plan would benefit about 130 residences and 80 commercial/industrial properties. Adverse impacts are those primarily associated with construction, such as noise, construction traffic, traffic delay and restricted activity near the construction site.

Economic Considerations - The selected plan would have a total first cost of $20,750,000 and an average annual cost of $1,486,000. With average annual benefits of $1,996,000 the plan has annual net benefits of $510,000 and a benefit to cost ratio of 1.34 to 1.

Features are included in the plan which will preserve the Town River wetland and no adverse impacts in the smelt resource are expected. Water quality features have been designed into the plan to avoid adverse impacts.

Summary Comparison of Final Alternative Plans

	Without Condition No Action	Plan A	Plan B
A. Plan Description	Most Probable Alternative Future	Bypass Tunnel Old Quincy Reservoir Improvements	Nonstructural Plan Flood Proofing Flood Warning & Evacuation
B. Impact Assessment			
1. National Economic Development (NED)			
a. Project First Costs			
Federal			
Proposed Policy		15,562,000	1,972,000
(Existing Policy)		(20,575,000)	(2,103,000)
Non-Federal			
Proposed Policy		5,188,000	657,000
(Existing Policy)		175,000	(526,000)
Total		20,750,000	2,629,000
b. Flood Damages			
Average Annual Flood Damage	2,062,000	2,062,000	2,062,000
Annual Residual Damages	NA	92,000	1,663,000
Annual Flood Damage Reduction	NA	1,970,000	399,000
Average Annual Benefits	NA	1,996,000	399,000
Average Annual Cost	NA	1,486,000	278,000
Net Benefits	NA	510,000	121,000
Benefit Cost Ratio	NA	1.34 to 1	1.43 to 1

2. Environmental Quality (EQ)

a. Man Made Resources

Parks and Recreation	No change from existing condition	Use of ball field (1 acre) off Pond Street lost during construction of tunnel. Stabilized level of Old Quincy Reservoir will benefit passive recreation use.	No change

b. Natural Resources

Air Quality	No major change from existing condition.	No major change Temporary decrease at construction sites.	No significant change
Water Quality	No long term change. Temporary increase in sediment during construction of transportation and drainage projects.	Temporary increase in sediment during construction. Potential water quality problems in tunnel will be prevented through mitigation measures.	Same as "No Action"
Animal and Plant Life	No significant change	Potential negative	No significant change

3.	Social Well Being (SWB)			
	a. Noise	NA	Temporary increase during construction in areas immediately surrounding the tunnel inlet and outlet, the dam at Old Quincy Reservoir, and the Southern Artery culverts.	Temporary increase during construction in residential and business areas.
	b. Displacement of People	Some relocation in relation to construction of transportation improvements.	No relocations	Displacement due to temporary evacuation during floods.
	c. Aesthetic Values	No change foreseen	Areas in flood plain should be enhanced as flood protection is realized. New concrete spillway will impose on landscape at Old Quincy Reservoir.	Appearance of buildings in flood plain may be be changed by low walls, blocking of openings, etc.
	d. Archeological Remains & Historic Structures	No change foreseen	Will disturb remains of rock dam which was part Town Brook Canal.	No change foreseen
	e. Recreation Opportunities	Improvement to existing recreation program and park system.	Same as No Action except temporary loss of ballfield at Pond Street field.	Same as "No Action"
	f. Community Cohesion	Improving as transportation and redevelopment projects are completed.	More stable as flood protection is provided.	Promotes community cooperation during flood events.

g.	Desirable Community Growth	Same as for Community Cohesion.	Flood protection enhances present urban renewal plan.	Same as "No Action"
h.	Transportation	Major transporation projects provide improved access to Boston and downtown business district.	Construction traffic on School Street, Pond Street, Southern Artery and Lakeside Drive. Traffic disruption and delay on Southern Artery.	Same as "No action"
i.	Health & Safety	No change	Eliminate health and safety threat from flood event	Provides for safe removal of residents during flood event.
4.	Regional Development			
a.	Tax Revenue	Stable	Stable	Same as "No action"
b.	Property Value	Stable	Increased property value in flood protected areas.	Same as "No action"
c.	Local Government Finances	Stable	Reduction in expenditure for emergency services during flooding. Increase in operation and maintenance costs for project measures.	No change expected.
d.	Desirable Regional Growth	Continued economic development	No impact	No impact
e.	Public Facilities & Public Services	Improved mass transit service.	Improved dam safety at Old Quincy Reservoir. Protects MBTA tracks	Same as "No action"

f. Employment/Labor Force	Stable	Construction jobs provided for 2 years.	Jobs created to install flood proofing.
g. Business and Industrial Activity	Urban renewal in Quincy will provide uplift to sagging business. Continued strong activity.	Flood control will reduce physical losses and encourage full use. Urban renewal plan will be enhanced.	Same as "No action"
C. Plan Evaluation			
1. Contribution to Planning Objectives			
a. Reduce Flood Damage	Ave. Ann. Damage of $1,877,000	Eliminates nearly all flood damage.	Partial reduction of flood damage. Substantial residual damage. Floodwaters still inundate areas causing disruption, evacuation, and cleanup.
b. Preserve smelt spawning area and salt marsh.	No change	Easements taken on wetland to prevent encroachment.	No Change
2. Net (with vs without) beneficial and adverse effects			
a. National Economic Development (NED)		Average annual net benefits of $510,000.	Average annual net benefits of $121,000
b. Environmental Quality (EQ)		Easements will preserve salt marsh.	No net beneficial or or adverse effects

c.	Social Well Being (SWB)		Reduction of flooding enhances residential area and protects residents.	No significant change
d.	Regional Development (RD)		Reduction of flooding enhances Quincy business district, urban renewal plans, and transportation facilities.	No significant change
3.	Plan Response			
a.	Acceptability	Not acceptable	Flood reduction by tunnel plan acceptable to public and agencies.	Not acceptable. Residents want to prevent flooding.
b.	Completeness.		Requires construction of planned drainage improvements by local agencies.	Same as Plan A
c.	Effectiveness		Most effective	Least effective
d.	Certainty		Implementation assures achieving goals.	Implementation is dependent on action of individual property owners.
e.	NED Benefit/Cost Ratio		1.34 to 1	1.43 to 1

f. Reversibility	Resources used for construction are irreversible. Measures at reservoir should be considered irreversible. Use of tunnel could be stopped but should be considered irreversible.	Resources used for construction are irreversible. Use of measures could be stopped and will be be considered reversible.
g. Stability	High	Low
D. Implementation Responsibility	Corps of Engineers Commonwealth of Massachusetts City of Quincy	Corps of Engineers Commonwealth of Massachusetts City of Quincy Town of Braintree Individual Property Owners

RECOMMENDED PLAN

Description

The recommended plan (shown in Figure 7, 8 and 9) consists of a 12-foot diameter relief tunnel, structural improvements at the Old Quincy Reservoir, larger culverts under the Southern Artery, purchase of easements on the Town River coastal marsh, widening the Town River channel just downstream of the Southern Artery and a flood warning and evacuation plan to protect against extreme events. Additional information is provided in the section "Assessment and Evaluation of Detailed Plans", presented earlier in the report.

Economics

The estimated first cost of the recommended plan is $20,750,000. Additional detail is presented in Appendix F.

The annual cost, based on a 100-year period of analysis, at an interest rate of 7-1/8 percent, is $1,486,000 of which $6,000 is for operation and maintenance.

Annual benefits associated with flood damage reduction total $1,996,000. Appendix I contains detailed analysis of benefits.

The recommended plan shows annual net benefits of $510,000. The benefit to cost ratio is 1.34 to 1.

Plan Implementation

The steps necessary to follow in realizing the construction of the proposed plan of improvements are summarized as follows:

- Review of this report by higher Corps of Engineers authorities such as the Board of Engineers for Rivers and Harbors and the Office of the Chief of Engineers.

- The Chief of Engineers would then seek formal review and comment by the Governor of Massachusetts and interested Federal agencies.

- Following the above State and interagency review, the final report of the Chief of Engineers would be forwarded by the Secretary of the Army to the Congress, subsequent to his seeking the comments of the U.S. Water Resources Council and of the Office of Management and Budget regarding the relationship of the project of the program of the President.

- Congressional authorization of the flood control project would then be required. This would include appropriate requests for design and construction of the project.

- If the project is authorized, the Chief of Engineers would then include funds, when appropriate, in his budget requests for design and construction of the project.

- If the Congress appropriates the necessary initial funds, formal assurances of local cooperation would be requested from non-Federal interests.

- Advance engineering and design studies would be initiated, project formulation reviewed, and the plan reaffirmed or modified to meet the then current conditions. Maximum possible use would be made of data and analyses from the Metropolitan District Commission (MDC).

- Surveys, materials investigations, and preparation of design criteria, plans, specifications, and an engineering estimate of cost would then be accomplished by the Division Engineer, bids invited, and a contract awarded. At this time, the necessary local actions would be required.

- Following completion of certain sections of the project, local interests would be repsonsible for their operation and maintenance.

Once the project is authorized and initially funded, it would be possible to complete design and construction within a 5-year period if adequate funds are available.

Operation and Maintenance

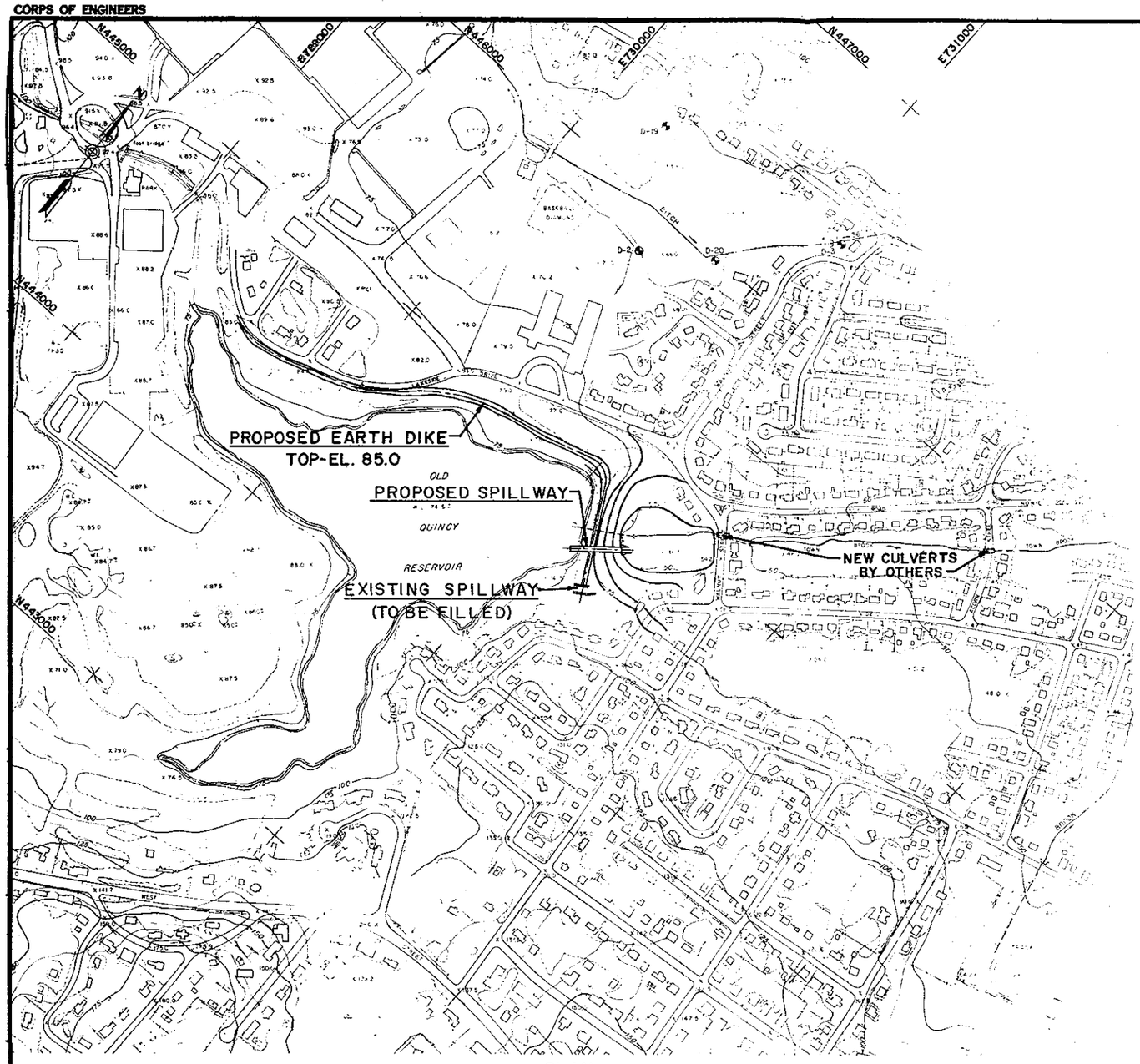
The proposed flood control system would be entirely automatic, and require no regular operation attention. The Old Quincy Reservoir low level control structure and controlled low volume discharge works would operate automatically and would require only occasional inspection after storms to insure against interference by floating debris. The tunnel would also operate automatically and would similarly require inspection periodically and after storms.

Removal of silt would be required from the tunnel inlet structure at least once a year. The tunnel would be pumped dry once every 5 years for inspection.

Inspection of all exposed structures, to determine when periodic maintenance or repair is necessary, should be provided on a routine basis or at least annually. All these activities would become part of normal city maintenance of its drainage system. Assurances will be required by local authorities that maintenance will be accomplished.

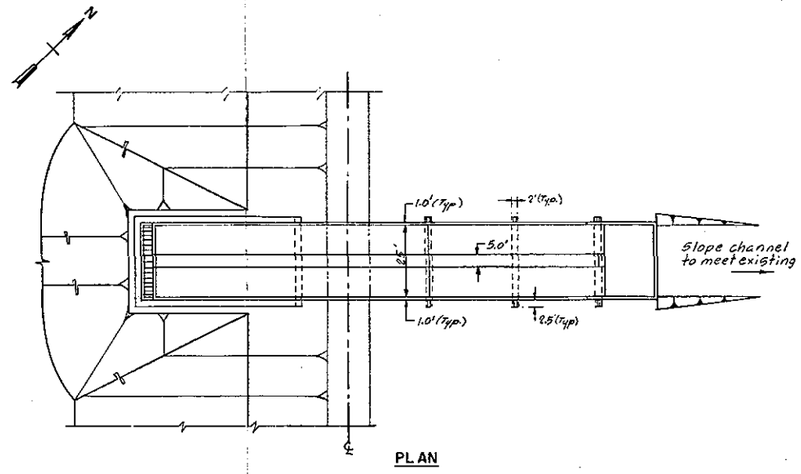
CORPS OF ENGINEERS

U. S. ARMY

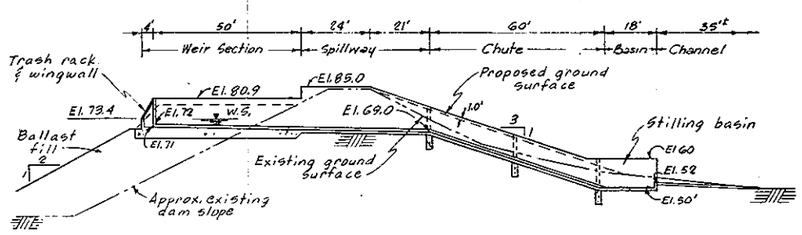


PLAN

SCALE: 1"= 200'



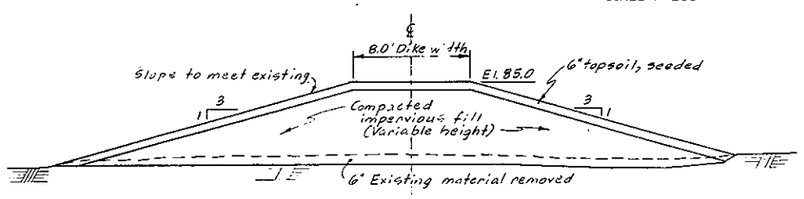
PLAN



℄ PROFILE

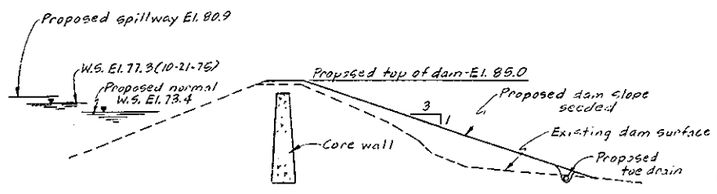
SPILLWAY

SCALE: 1"= 20'



TYPICAL DIKE SECTION

SCALE: 1"= 4'



DAM SECTION

SCALE: 1"= 20'

GRAPHIC SCALES

1"=200' 200' 0 200' 400'

1"=20' 20' 0 20' 40'

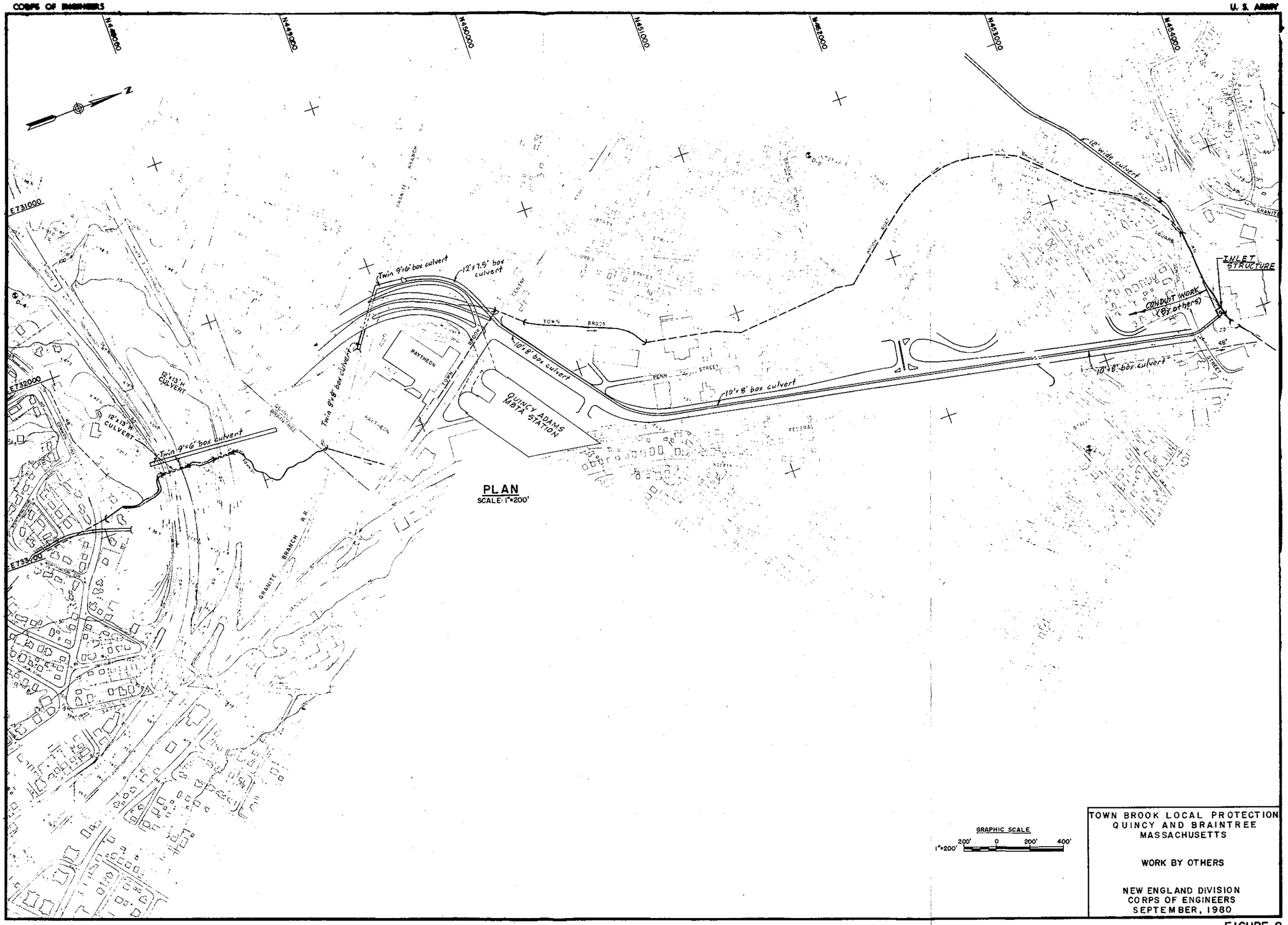
1"=4' 4' 0 4' 8'

TOWN BROOK LOCAL PROTECTION
QUINCY AND BRAINTREE
MASSACHUSETTS

PROPOSED IMPROVEMENT
OLD QUINCY RESERVOIR

NEW ENGLAND DIVISION
CORPS OF ENGINEERS
SEPTEMBER, 1980

FIGURE 7



PLAN
SCALE: 1"=200'

GRAPHIC SCALE
1"=200' 200' 0 200' 400'

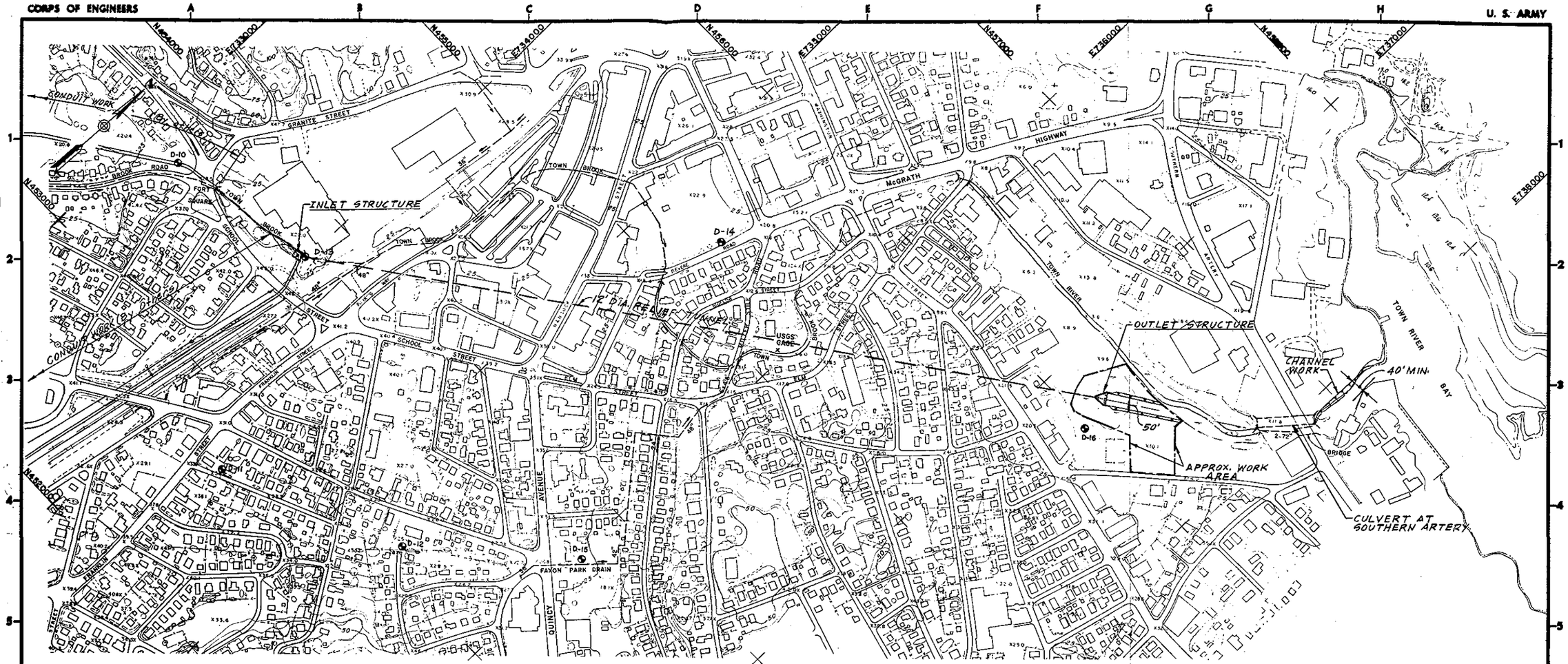
TOWN BROOK LOCAL PROTECTION
QUINCY AND BRAINTREE
MASSACHUSETTS

WORK BY OTHERS

NEW ENGLAND DIVISION
CORPS OF ENGINEERS
SEPTEMBER, 1980

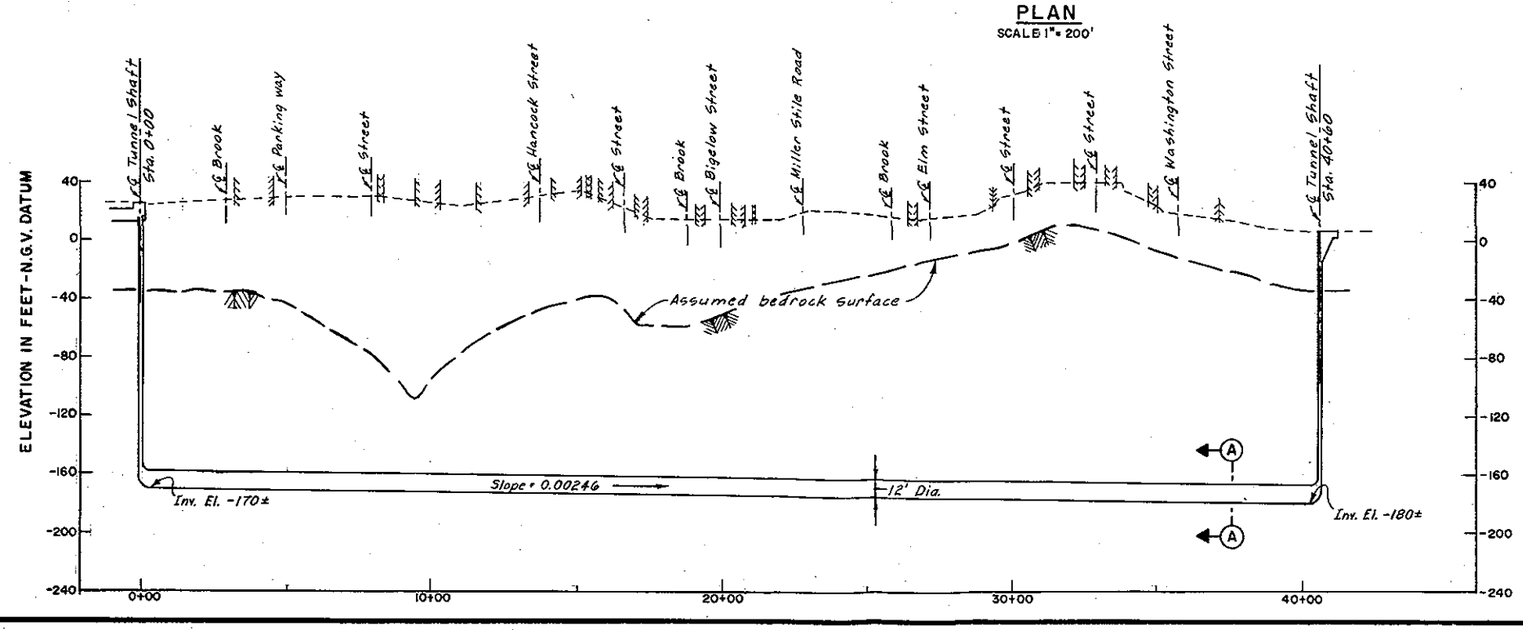
FIGURE 8

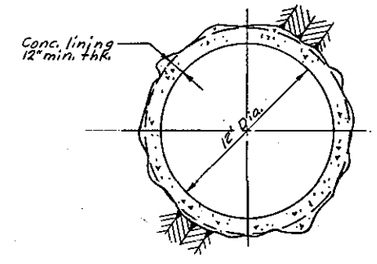
CORPS OF ENGINEERS — U. S. ARMY



PLAN

SCALE 1" = 200'





SECTION A-A

SCALE: 1" = 4'

℄ PROFILE

SCALE: HORIZ. 1" = 200'
VERT. 1" = 40'

GRAPHIC SCALES

1" = 200' — 200' 0 200' 400'
1" = 40' — 40' 0 40' 80'
1" = 4' — 4' 0 4' 8'

TOWN BROOK LOCAL PROTECTION
QUINCY AND BRAINTREE
MASSACHUSETTS

PROPOSED IMPROVEMENT
RELIEF TUNNEL

NEW ENGLAND DIVISION
CORPS OF ENGINEERS
SEPTEMBER, 1980

FIGURE 9

Town Brook Local Protection Project

Massachusetts Coastal Streams

Quincy and Braintree, Massachusetts

Environmental Assessment

New England Division
U.S. Army Corps of Engineers
Waltham, Massachusetts

September 1980

Finding of No Significant Impact
Town Brook Flood Protection Project

The Environmental Assessment for this project is attached and it describes the need for a project, the planned action, an alternative solution, and the anticipated environmental impact.

Implementation of the proposed project will not require a significant commitment of physical, natural or human resources. Coordination among all parties during the planning process has resulted in the recommended plan of improvement. The impacts have been outlined in the assessment summary and detailed in the assessment and in the appendices to the project report. There does not appear to be any remaining major environmental problem, conflict or disagreement in the selection of the improvement. I have determined that implementation of the proposed action will not have a significant adverse impact on the human environment.

29 Sep 80
DATE

William E. Hodgson Lt Col CE
for MAX B. SCHEIDER
Colonel, Corps of Engineers
Division Engineer

Environmental Assessment
Town Brook Flood Control Project
Quincy, Massachusetts

Summary

Responsible Office: U.S. Army Corps of Engineers
New England Division
Waltham, Massachusetts 02154
(for Information contact Rob Adler)
617-894-2400, ext. 231)

Project Objective

The objective was to determine the feasibiilty of addressing flooding and other problems along Town Brook and enhances environmental quality as possible.

Project Need

Serious flooding along Town Brook has caused damages to residential and business properties. Annual flood losses are estimated at $2.1 million and, under present conditions, the worst flood on record (1955) would now cause damages worth more than $13 million. Severe floods cause personal hardships with losses that cannot be covered adequately by insurance. The safety and health of residents can be threatened and services could be disrupted.

Alternatives

Two solutions to the flooding were deemed most feasible:

(1) The proposed solution is Plan A, which includes a dike and improved outlet/spillway at the Old Quincy Reservoir, a diversion tunnel to relieve flooding in Town Brook and a flood warning and evacuation plan.

(2) Plan B, a nonstructural plan, which includes flood proofing measures, a flood warning and evacuation plan, and use of the existing Old Quincy Reservoir for flood control storage.

Environmental Impacts

Plan A would have minimal impacts on the local and regional environment. Construction would be temporary and would not impact on the area's terrestrial, stream and estuarine ecosystems or the smelt resource. Temporary construction impacts on the environment are those normally associated with site development on a project and would include temporary stream siltation, added noise and dust, the removal of small areas of trees or other onsite vegetation. Potential water quality problems are being addressed by design features in the proposed tunnel. Detailed water quality studies

would be conducted before final designs are completed. Increased discharges and the proposed widening of the river's outlet will impact on a channel lock. The historical significance of the lock will be studied to determine if mitigation will be required. The major beneficial economic and social effect would be protection of residential and business properties against the 100 year flood level. During construction social impacts are short term and are not severe. They may include such inconveniences as traffic delays, detour routes and playground disruptions.

Plan B will have essentially no impact on the natural environment, while taking no action would have the effect of promoting economic decay in high impact areas and allowing continued flood losses. Although flood proofing will reduce some residential structural damages, flooding will continue so that residences will still have to be evacuated, businesses will still be disrupted and properties will continue to deteriorate from repeated flooding events.

ENVIRONMENTAL ASSESSMENT

1. Purpose and Need for Action

The recurring flooding problems of the Town Brook watershed, located in Braintree and Quincy, Massachusetts, were evaluated. The need for providing flood relief to these areas has already been presented in detail in the Project Report.

In general, flooding in the area has been caused by intense rain storms associated with spring or late summer hurricanes and northeast coastal storms. Most notable were Hurricane Diane in August 1955, the flood of record, and the rain storm of March 1968. Less severe storms have caused flooding in 1954, 1961, 1969, 1973, 1974, 1975 and 1979. Recent increases in flood frequency and magnitude have resulted from continued development in upstream areas and further encroachment and restriction of Town Brook as it flows through urban areas. Damages in Braintree occurred when Old Quincy Reservoir overflowed its north bank into adjacent residential areas. Below the reservoir in Quincy, "flashy" runoffs from urban areas and inadequate channel capacity cause water to back up, forming six discrete "pools" which flooded streets, homes, businesses and railroad tracks. It is expected that annual losses will continue to average $2.1 million.

2. Proposed Action and Alternatives

A. Proposed Improvement

The reservoir improvement and tunnel plan includes structural remedies to help relieve flooding conditions. Flood relief of the Old Quincy Reservoir will be accomplished by constructing a 4-foot high dike along the north shore to contain floodwaters. Improvement and modification of the present outlet structure would maintain normal water levels at 73.4 feet, and provide enlarged emergency spillway capacity to pass flows from a "standard project" flood. To relieve the principal flooding downstream a 4,000-foot bypass tunnel is proposed with an inlet near School Street adjacent to the MBTA "Red Line" and the proposed Burgin Parkway. The outlet would be located at the lower reach of Town River just upstream of the Southern Artery and adjacent to the salt marsh. In addition, new culverts would be installed under the Southern Artery and the channel would be widened to accommodate larger outflows. A flood warning plan is also included to protect against infrequent storms which are very severe in nature.

B. Plan B

Measures in this nonstructural alternative include flood proofing, a flood warning and evacuation plan, and using storage in the existing Old Quincy Reservoir for flood control. Flood proofing measures such as utility cells and ringwalls provide only limited protection. Business and residence owners will need to rely on flood insurance for economic relief from residual flood

damages. Maintenance of the pool level at Old Quincy Reservoir 7-1/2 feet below the existing spillway crest will provide flood storage capacity for runoff from the upstream end of the watershed.

Detailed descriptions of both these plans are discussed in the "Assessment and Evaluation of Detailed Plans" section of the report.

3. Affected Environment

Town Brook is located in the city of Quincy and the town of Braintree about 7 miles south of Boston. The watershed covers approximately 4.5 square miles. Town Brook originates in the undeveloped wooded Blue Hills Reservation and flows into the Old Quincy Reservoir. Downstream of the reservoir, the brook traverses through a residential, commercial and industrial area with approximately 40 percent of the natural channel covered by development. Town Brook becomes Town River in its lower reaches and terminates in Town River Bay.

A. Natural Resources

Because the watershed below the Blue Hills Reservation is highly urbanized there are few remaining open spaces and natural areas. Major ecological features existing in the project study area are the Old Quincy Reservoir, an upstream freshwater wetland, the smelt resource and the Town River coastal wetland.

Old Quincy Reservoir. Damming of Town Brook in the late 1800's in Braintree formed the Quincy Reservoir and supplied water to the city of Quincy until 30 years ago. When the regional water system was connected to Quincy, the reservoir became an industrial water supply and offered limited opportunity for swimming and fishing although such use has since been discouraged. Constantly fluctuating waters erode the shallow top soils which limit shore vegetation. There is a limited fishery of yellow perch, bullhead and pickerel which is probably due to the acid nature of the water.

Upstream Freshwater Wetland. An 8 to 10 acre freshwater wetland occurs in a 60-acre wooded site between Route 3 and Centre Street in Quincy. The area generally supports a variety of wetland grasses and flood tolerant hardwoods that are flooded during excessive discharges. The U.S. Fish & Wildlife Service stated in their planning aid letter of 27 April 1979, that the area "is not a highly significant wildlife area," but would provide a small habitat for small ground mammals and nesting area and ducks.

Smelt Resource. Between Revere Road and the McGrath Highway at Elm Street, Town Brook surfaces from beneath the Quincy business center as an open stonewalled channel providing approximately 1,500 feet of favorable rainbow smelt (Osmerus mordax) spawning bed. This area is limited upstream by low level obstacles at Revere Road and downstream by the tidal influence which migrating smelt must avoid to spawn in freshwater. Smelt spawn in

freshwater and normally avoid contact with coastally influenced water. The reach of river between Elm Street and Town River Bay serves as the migration path. Smelt is the only fish resource in this reach of Town Brook. For further information, see Smelt Resource page G-2.

Town River Coastal Wetland. The 5 acre coastal wetland is located downstream of Elm Street as two elongated 2,000 foot strips along both sides of the Town River. Dominant vegetation includes saltwater cord grass (Spartina alterniflora), salt meadow grass (S. patens), and a common reed (Phragmites communis). Channels and small tributaries contain a variety of typical estuarine fish and invertebrates. In addition, the marsh provides a variety of habitats for birds and mammals in the otherwise heavily developed city of Quincy.

Other natural resources in the area include a small bed of soft shell clams at the mouth of Town River. The bed is not harvested and represents a small fraction of the clam resources in the region.

The existing natural resources in the project area are more fully described in Appendix G.

B. Water Quality

The available water quality information for Town Brook is summarized in Appendix D. Generally, the water quality standard is Class B for freshwater and Class SB in the coastal tidal section of the brook. Although the brook does not receive domestic wastes, its water quality is substantially influenced by urban runoff and drainage.

C. Cultural Resources

The only known historical or archaeological resource in the project study area is the 19th century wooden and stone lock located at the mouth of the Town River inlet. It is now inoperable and most of the remaining structure is below water. The upper gates on the lock are no longer in existence. The significance of the lock as a historical site has not yet been determined. More detailed information concerning the lock and other potential cultural resources are found in Appendix H. (Also see photos in Problem Identification section of the report.)

D. Socio-Economic Resources

The city of Quincy in 1975, had a population of 91,494 resulting from continuous growth over the past several decades. Projections have indicated that this predominantly blue collar population will grow to a population of 95,000 by year 2000. Historically, Quincy has been a manufacturing center, although services sector has recently gained in economic importance. Land use is predominantly residential, 35 percent; followed by forest open space (Blue Hills Reservation), 33 percent; and wetlands 7 percent. Other uses such

as commercial or industrial development consume no more than 5 percent each. More detailed information on the existing socio-economic resources are described in Appendix H.

4. Environmental Consequences

A. Effects of the Reservoir Improvement and Tunnel Plan

1. Natural Resources

The proposed flood control improvements generally would have minimal impacts on local and regional environmental resources. General construction activities would be temporary and would not severely impact the area's terrestrial, stream and estuarine ecosystems or the smelt resource. The only potential long term impact that could arise from project implementation is degradation of the quality of water in the tunnel, which is being addressed by design features. A detailed assessment of impacts on specific resources is discussed in Appendix G and summarized below.

a. Blue Hills Reservation - No project improvements are proposed upstream of the Old Quincy Reservoir so there are no anticipated impacts to this area.

b. Old Quincy Reservoir - Construction and operation of the present outlet/spillway modification and the new emergency outlet/spillway will not adversely affect the existing reservoir ecosystem or Town Brook below the reservoir. Partial lowering of the reservoir would only occur during construction, and it would return to its present level after construction is completed. The temperature regime of this shallow lake would not be markedly different. Construction of the new spillway through the dam will reduce the number of trees to be removed by minimizing the impact on adjacent lands and properties.

Siltation from construction activities will cause temporary turbidity in the reservoir, which will be confined to a small area due to the lack of currents in the reservoir. Minor siltation of Town Brook would have little impact on the stream's aquatic life. Construction during smelt spawning season (April/May) will be carefully monitored to insure no impact on the spawning area, which is a couple of miles downstream from the construction site.

c. Old Quincy Reservoir to Tunnel Inlet Structure - There is no plan of improvement for this section of Town Brook. However, the Metropolitan District Commission (MDC) has developed plans and made structural improvements to the channel and culverts as described in the report. The freshwater wetland between Route 3 and Centre Street will not be altered.

d. Tunnel Inlet - Construction of the inlet shaft to the tunnel will require the taking of 2,000 square feet (40 feet x 50 feet) adjacent to Town

Brook in the vicinity of the MBTA tracks and the proposed Burgin Parkway. This area has been greatly altered, and the taking will not remove any significant terrestrial habitat. The inlet structure is adjacent to the brook and will not interfere with normal flow, because it will only accept brook water when the flows exceed a predetermined flow assumed now to be 100 cfs. The downstream spawning smelt may benefit if high flows are diverted above the spawning area. It would reduce the possibility of high velocity floodflows causing heavy siltation, washing out a new spawn or introducing urban runoff.

Construction impacts would involve turbidity caused by disturbing the stream sides and bottom. The activity should not occur during the smelt spawning season to avoid impacting the spawn. Mitigating measures to reduce turbidity should minimize the downstream impacts.

The general construction of the tunnel and the inlet and outlet shafts will not impact any natural resources except for the removal of the bedrock, 100 feet below the surface. This is not expected to affect the environment at the surface. The shaft and tunnel excavation will generate approximately 25,000 cubic yards of fractured rock with pieces about a half-foot in size. Most of the material will be removed through the outlet shaft and loaded onto dump trucks for carting. Even though the exact disposition of the material, or a disposal site for it, has not been identified, several alternatives exist and will be evaluated for potential impacts. The alternatives include selling or releasing the rock for municipal projects, crushing and using it for commercial fill, or as fill by the town of Quincy to regrade old granite quarries, discarding it in acceptable vacant lots, or using it in conjunction with a coastal fishery by creating a shallow rocky area.

e. Downtown Quincy to Revere Road - The proposed project would not adversely affect any natural resources in this area since the tunnel is 190 feet below the city of Quincy.

f. Revere Road to Elm Street - Since no structural improvements are planned for this section of Town Brook, no adverse impacts are expected. This area includes the smelt spawning beds, which are not expected to be impacted provided that mitigative measures for construction activities are followed upstream at the inlet construction site.

g. Elm Street to Town River Bay - Construction of the tunnel outlet located midway in this area would require removal of about a quarter acre of a well-drained, sparsely wooded open area and would cause temporary disruption of use of an adjacent baseball field. High water velocities emanating from the outlet during a 100-year flood may cause damage or remove wetland plants and animals in the line of flow. Remedies to minimize this problem such as flaring of the channel, energy dissipators near the outlet, or matting of the wetland in the line of flow would be investigated at a later stage of planning to minimize wetland damage.

In the proposed project there is no plan for using wetland for structures. However, it should be anticipated that as much as a half acre of wetland may be temporarily disturbed for construction equipment movements or otherwise permanently used to "tie-in" the outlet structure's discharge channel. Any disturbed wetland will be regraded for restoration.

The project will ultimately preserve most of the wetland's natural integrity. The wetland will either be purchased or easements obtained so that it can be maintained as a flood discharge area elimimating the continued pressure to fill it and encroach on the channel.

The intermittent influx of storm water and seawater will keep the tunnel completely filled with water. Accretion of organic matter associated with these influxes would increase the biological oxygen demand (BOD) of the tunnel water and anaerobic conditions would likely prevail if the tunnel water is not periodically flushed. A water circulation system has been designed into the tunnel to prevent these problems.

Downstream of the salt marsh, the existing 72 inch pipes under the Southern Artery will be replaced with three larger box culverts to accommodate higher flows. In addition, widening of the inlet channel will involve removal of about 1,000 cubic yards of material from the left bank. Siltation from onsite construction activities may cause temporary deleterious effects on the small shellfish bed in the mouth of the Town River. The wider channel would allow more seawater to flow inland during high tide but flap gates at the box culvert would restrict flow to its previous levels.

2. Cultural Resources

Widening of the channel below the Southern Artery would remove the channel back (see Figure 9) and sediments around the lock. The lock would be removed since it would obstruct floodflows and would eventually be eroded away. At present the tidal action in Town River is naturally eroding and degrading the condition of the lock. In time the lock would no longer be recognizable or of historic value. However, for the next stage of project planning, the Corps of Engineers will seek a determination of eligibility for the National Register for this structure. If the lock is determined eligible, a mitigation plan will then be developed. The area adjoining the Old Quincy Reservoir may have potential for prehistoric sites. More detailed study is planned to determine the presence or absence of such sites. A more detailed account of the cultural impacts may be found in Appendix H.

3. Socioeconomic Resources

Implementation of the structural plan raises a number of social considerations specific to the inlet site, the outlet site, the Old Quincy Reservoir area, and the flood plain area protected by the project. Major adverse impacts expected during the construction phase involve disruption of normal activities within and around the four areas. "Typical" construction-

related impacts that can be expected to occur include increased levels of noise and dust, increased heavy truck traffic, and increased use of local roads. These impacts are temporary and would not result in long term effects. Southern Artery traffic will have detours and delays.

The most significant beneficial impact, the flood control protection, meets the planning objective of the study. Damages to residential and commercial structures within the major flood pools are almost eliminated during the 100-year event. The provision of flood control protection complements Quincy's future plans for growth and development.

More details of the project's effects and their occurrence as they relate to the four areas mentioned above is provided in Appendix H, Social and Cultural Resources.

B. Effects of Plan B and No Action

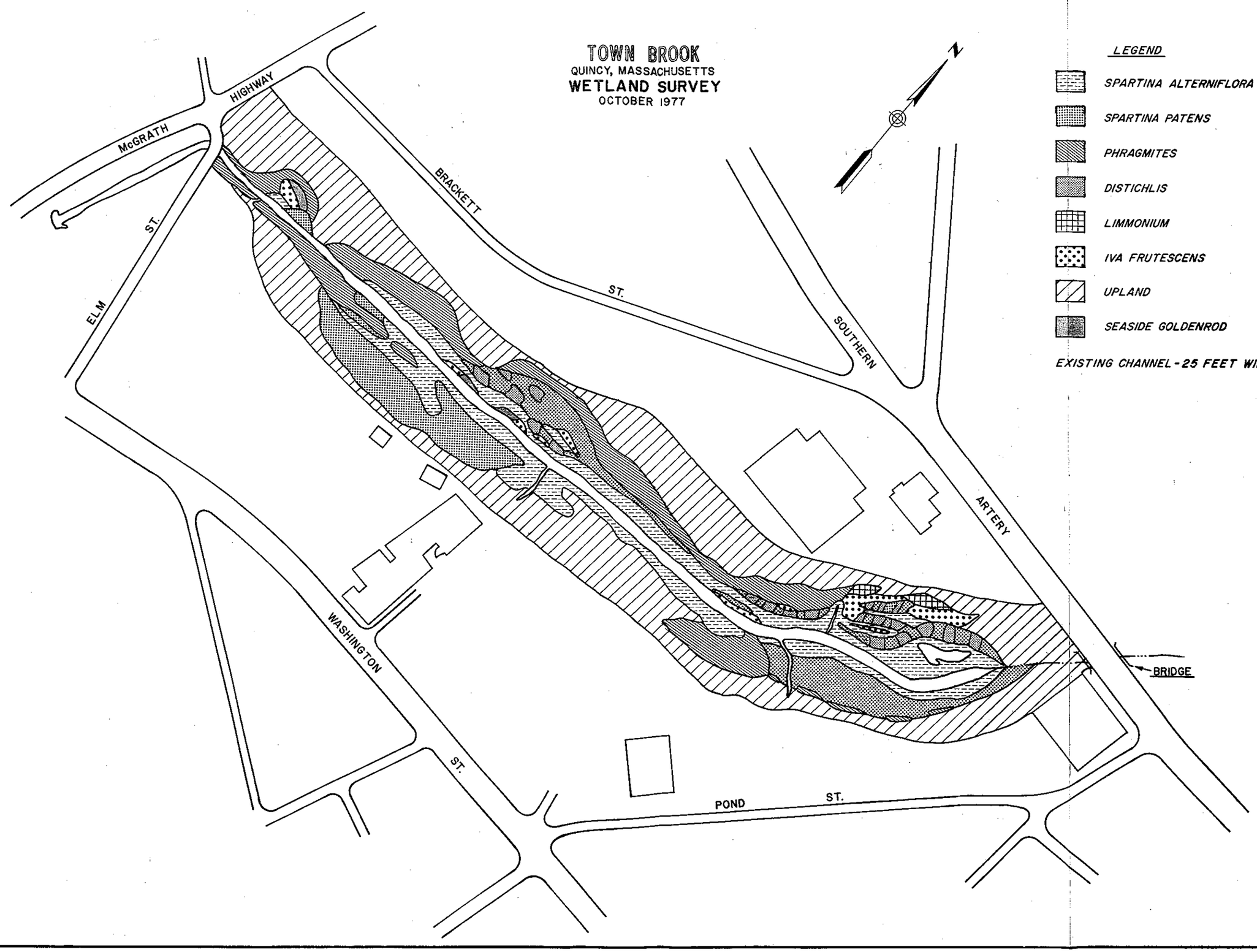
The nonstructural plan includes a flood proofing program supplemented by a flood forecasting, warning and evacuation plan and flood insurance.

Flood proofing measures would reduce the amount of structural damages received by homes and businesses within the flood pools. The measures recommended to accomplish this include replacing foundations with reinforced concrete foundations, providing a second foundation wall, and water proofing exterior foundation walls. Where this is not feasible, the construction of utility cells has been recommended. Although these cells would not prohibit water from entering the structure, they would protect the major utilities.

Commercial structures, especially those within the shopping center, would not be particularly suited to flood proofing measures and would have to rely on flood insurance to provide economic relief. Flood insurance would also be beneficial to homes only flood proofed by utility cells.

As opposed to reducing economic losses, the major thrust of the warning and evacuation element of the nonstructural plan is the protection of lives through the timely removal of residents threatened by the flood.

TOWN BROOK
QUINCY, MASSACHUSETTS
WETLAND SURVEY
OCTOBER 1977



LEGEND

- SPARTINA ALTERNIFLORA
- SPARTINA PATENS
- PHRAGMITES
- DISTICHLIS
- LIMMONIUM
- IVA FRUTESCENS
- UPLAND
- SEASIDE GOLDENROD

EXISTING CHANNEL - 25 FEET WIDE

Section 404(b) Guidelines

for

Town Brook Local Protection Project

Massachusetts Coastal Streams

Quincy and Braintree, Massachusetts

1. References.

a. Section 404(b) of Public Law 92-500, as amended, Clean Water Act.

b. 40 CFR 230.4 - 230.5, dated 5 September 1975.

c. EC 1105-2-90 Appendix C, dated 8 May 1979

2. The Proposed Project

The proposed project would provide protection to several areas along Town Brook that are prone to recurrent flooding. This would be accomplished essentially be two separate project elements. The first includes increasing the storage capacity of the Quincy Reservoir by adding a dike along one section of the reservoir's perimeter and constructing a new spillway to control water levels. The dike would be constructed on dry land and the spillway would be built through the existing reservoir dam.

The second project element is the design of a deep subsurface tunnel with an inlet constructed beside, or adjacent to, the existing Town Brook and an outlet shaft emerging on dry land just above the Town River wetland. Water emerging from the tunnel would be directed into the tidal wetland and passed under the Southern Artery into Town Bay. The two culverts which now carry Town River beneath the Southern Artery would be replaced with three new culverts of increased size.

Those aspects of the project requiring review under Section 404 include: (1) the placement of concrete for a 25 foot wide spillway along the wetted upstream side of the dam; (2) riprap slope protection on upstream face of dam; (3) placement of temporary forms for a short concrete wall (as part of inlet structure) to be poured in place of the streams existing stone wall; and (4) the placement of three culverts to replace two existing culverts to provide additional discharge capacity beneath the Southern Artery.

3. Project Authority and Present Status

Under authority contained in the congressional resolution of 2 December 1970 of the Committee on Public Works, studies were made to determine the need and feasibility of providing local flood protection along Town Brook in Braintree and Quincy, Massachusetts. Upon completion of public review and resolution of any outstanding concerns, the Feasibility Report with the Environmental Assessment and the Section 404(b) Evaluation will be forwarded to the Chief of Engineers for approval and for Congressional appropriation. Appropriation of project funds would initiate development of plans and specifications for construction.

4. Environmental Concerns

The proposed project will reduce economic losses to residences and commercial businesses, hardships, and inconveniences caused by flooding. The initial design of the project has undergone several modifications to arrive at the present project which reduces or mitigates the impacts of the earlier concepts. The proposed project is considered to have no unacceptable long-term adverse impacts.

5. Technical Evaluation

A technical evaluation with respect to disposal of fill material and potential environmental impacts resulting from such disposal has been completed. The results are presented on page 4. Concomitant reading of or adequate familiarity with Section 404(b) Guidelines will insure understanding of results presented in the technical evaluation.

6. Conclusions

Determinations

a. An ecological evaluation has been made following the evaluation guidance in 40 CFR 230.4, in conjunction with the evaluation considerations in 40 CFR 230.5

b. Appropriate measures have been identified and incorporated in the proposed plan to minimize adverse impacts on the aquatic environment as a result of the discharge.

c. Consideration has been given to the need for the proposed activity, the availability of alternate sites and methods of disposal that are less damaging to the environment, and such water quality standards as are appropriate and applicable by law.

d. Providing local flood protection along Town Brook will require the placement of fill for structures or erosion control features. Except for new flow through culverts that will replace existing culverts all structures will be constructed on dry land or to the side, adjacent to, the reservoir and the stream's present channel. Other than the temporary placement of concrete forms or retaining walls no permanent structure will interfere with the stream's flow or aquatic environments.

   Placement of fill material is expected to improve the human and economic environment by reducing flooding and improving the local residential and urban business climate.

Findings

The discharge sites for the placement of flood control measures along Town Brook, in Braintree and Quincy, Massachusetts has been specified through the application of Section 404(b) Guidelines.

The project files and Federal regulations were reviewed to properly evaluate the objectives of Section 404(b) of Public Law 92-500, as amended. A public notice with respect to the 404 Evaluation will be prepared. A thorough review of the project's planning process, the alternatives that have been considered and the environmental impacts have been presented in the projects Feasibility Report, which includes an Environmental Assessment. The reader should refer to the report to supplement this Section 404(b) review. Based on the information contained in the Technical Evaluation and referenced Feasibility Report, I find the project will not result in unacceptable impacts to the environment.

29 Sept 80
DATE

MAX B. SCHEIDER
Colonel, Corps of Engineers
Division Engineer

230.4-1 Physical and Chemical-Biological Interaction Effects

(a) Physical Effects (1 through 3)

(1) Effects on Wetlands.

The proposed location of the tunnel's outlet shaft is in an upland area adjacent to the Town River tidal wetland. Waters exiting the tunnel will be released through an energy reducing channel directed toward the Town River. The outlet was located to minimize destruction of the wetland for structures. Up to ½ acre of existing 5 acres of wetland may be temporarily disturbed for the construction of the dispersion channel. Disturbed area would be regraded for restoration. The wetland land will be purchased to be maintained as wetland to eliminate further encroachment. The wetland is expected to be kept in its natural condition to insure adequate flood discharge capacity.

(2) Effects on the Water Column.

Construction activities are expected to temporarily increase turbidity levels, reduce aesthetics but is not expected to cause any siltation in Town Brook/Town River. No long term impacts are expected. Town River is fully tidal through the wetland entering Town River Bay. With complete flushing action and characteristics of the tidal area, no long term adverse effects are expected.

(3) Effect on Benthos.

No adverse effect is expected.

(b) Chemical-Biological Interactive Effects (1 through 3)

(1) Fill material meets one of the conditions specified in paragraphs (b)(1)(i)(ii) and (iii) of this section. As such, it has been excluded from procedures specified in paragraphs (b)(2) and (3) of this section.

(i) Fill material will be composed of concrete, wood, gravel and sand, and have grain size larger than silt.

(ii) There is no beach restoration associated with this project.

(iii)(a) Fill material (concrete, sand, gravel and wood) is not substantially the same as the sediments found at the construction site (dirt and silt).

(b) All fill material will be obtained from a clean commercial source and will be free of undesirable contaminants.

(c) Construction of the flood control elements will be designed to insure all fill material remains at the disposal site.

(c) Procedure for Comparison of Sites (1 and 2)

(1) Not applicable. The project does not involve dredging sediments.

(2) Analysis of the biological community at the project site is considered unnecessary. Placement of clean fill material along Town Brook/Town River will not result in degradation of water quality or release undesirable contaminants in the surrounding environment.

230.4-1 Water Quality Considerations

Placement of clean fill material along the stream will not violate such water quality standards as are appropriate and applicable by law.

230.5 Selection of Disposal Sites and Conditioning of Discharges of Dredged or Fill Material

(a) General Considerations and Objectives (1 through 8)

(1) Discharge of clean fill will not significantly disrupt the chemical physical or biological integrity of the aquatic ecosystem.

(2) Discharge activities should not significantly disrupt the food chain in such a manner as to alter or decrease diversity of plant or animal species.

(3) Discharge activities may temporarily disrupt faunal movement but is not expected to significantly interfere with movement into and out of feeding, spawning, breeding or nursery areas. Smelt spawn is not expected to be adversely affected by any new structures. Any potential turbidity problems will be mitigated by off-season construction or other designed mitigation measures.

(4) Purchase of the wetland to eliminate encroachment will enhance its preservation and insure adequate flood discharge capacity for Town River. Selection of the outlet shaft was chosen to minimize wetland distruction. Not greater than one-half acre will be affected.

(5) Discharge of fill for flood control will not isolate areas that serve the function of retaining natural high waters or flood waters.

(6) Adverse turbidity levels from discharge activities will be minimized to the extent practicable.

(7) Discharge of clean fill material will not degrade water quality as determined through application of Sections 230.4, 230.5 (c) and (d).

(b) Considerations Relating to Degradation of Water Uses at Proposed Disposal Sites (1 through 10)

(1) Municipal Water Supply Intakes.

Not applicable. There are no public water supply intakes in or near the project area.

(2) Shellfish (i through iv)

(i) Not applicable. The area of proposed construction does not support concentrated shellfish production.

(ii) Not applicable. Discharge of clean fill will not release pollutants that could be moved by currents or wave action into productive shellfish beds.

(iii) Discharge of fill will not cause undesirable changes in current patterns, salinity patterns and flushing rates which could affect shellfish.

(iv) Construction activities are not expected to interfere with reproductive processes or cause undue stress to juvenile forms of shellfish.

(3) Fisheries (i through iii)

(i) Discharge of fill should not significantly disrupt the smelt or any other fish spawning or nursery areas.

(ii) Discharge of fill material will either be scheduled to avoid interference with fish spawning cycles or migration patterns and routes, or mitigated features would be specially designed to ensure no impact or migration obstruction.

(iii) Not applicable. There is no significant submersed or emergent vegetation at the project site.

(4) Wildlife

Discharge of fill should have little, if any, impact on habitat, the food chain or community structures of wildlife and marine or aquatic sanctuaries.

(5) Recreational Activities (i through iv)

(i) Reasonable methods will be employed to minimize any increase in amount or duration of turbidity which would reduce the numbers and diversity of fish or cause a significant aesthetically displeasing change in the color, taste or odor of the water.

(ii) Not applicable. Clean fill will not release nutrients which might result in eutrophication, degrade aesthetic values or impair any recreational uses around Town Brook.

(iii) Not applicable. Fill material will be obtained from a clean commercial source and will be free of unacceptable levels of pathogens.

(iv) Not applicable. Fill material will be free of oil and grease in harmful quantities as defined in 40 CFR 110.

(6) Threatened and Endangered Species.

No known threatened or endangered species inhabit the project area nor would the project, as proposed, destroy or modify critical habitat of such species in a way to jeopardize their continued existence.

(7) Benthic Life

Discharge of fill will destroy those benthic organisms inhabiting the immediate area of construction. But, the area to be affected by fill is so small that it is considered to be no impact.

(8) Wetlands (i and ii)

(i) Not applicable. Discharge of dredged material will not occur.

(ii)(a) Discharge of fill material along Town Brook will provide flood protection and must be done in association with, and in proximity to, Town Brook. Other sites or construction alternatives are not practicable. All proposed fill sites will be reviewed for construction alternatives that would mitigate potential adverse effects. The wetland will be purchased for its protection for flood control purposes.

(b) Fill for the construction of flood protection measures will not cause permanent unacceptable disruption of beneficial water quality uses in Town Brook/Town River and the bay. The potential for waters in the tunnel becoming anoxic will be studied and evaluated. If the evaluation indicates a potential problem contingency measures would be designed into the tunnel to mitigate any degradation of water quality resulting from tunnel stagnation. Monitoring during operation may be used to indicate any formation of anoxic conditions.

(9) Submersed Vegetation.

Not applicable. There is no significant submersed vegetation at the project site.

(10) Size of Disposal Site.

There are several small disposal sites to receive some fill. They include several thousand square feet of riprap and spillway structure area along the upstream fall of the reservoir dam, a couple hundred square feet for temporary concrete forms at the inlet structure, and a half-acre of fill where the new culverts will replace the existing culverts. The new culverts will not occupy any new stream area beyond what the existing culverts occupy.

(c) Other Considerations (1 through 7)

(1) Appropriate scientific literature was incorporated on the project design.

(2) Not applicable. The project is designed to provide flood protection and does not require disposal in open waters.

(3) Not applicable. There is no open water disposal.

(4) Not applicable. The project involves providing flood protection along Town Brook.

(5) Not applicable. All fill material will be obtained from a clean commercial source.

(6) Not applicable. Discharge activities will not create any confined areas.

(7) Because of the nature of the project (shoreline protection), the relatively small area involved and the long term beneficial impacts of this project, monitoring is deemed unnecessary except for water quality consideration while the tunnel is in operation.

(d) Contaminated Fill Restrictions.

Not applicable. All fill material will be obtained from a clean commercial land source and will be free of undesirable constituents in critical constituents.

(e) Mixing Zone Determinations (1 through 6)

Not applicable. Mixing zone determinations apply to open water disposal of materials.

RECOMMENDATIONS

It is recommended that the relief tunnel and reservoir improvement plan for Town Brook in the city of Quincy and town of Braintree, described as the recommended plan in this report and shown in figures 7, 8, and 9, be authorized for Federal construction, with such modifications as the Chief of Engineers may find advisable.

The President, in his June 1978 water policy message to Congress, proposed several changes in cost-sharing for water resources projects to allow States to participate more actively in project implementation decisions and to equalize cost-sharing between structural and nonstructural flood damage prevention projects. These changes include a cash contribution from benefiting States of 5 percent of the first costs of construction assigned to nonvendible project purposed and 10 percent of the first costs of construction assigned to vendible project purposed. Application of this policy to the Town Brook project would require the Commonwealth of Massachusetts to contribute an estimated $1,038,000 in cash (5 percent of $20,750,000 total estmated project first costs of construction assigned to nonvendible project purposes based on March 1980 price levels).

The President also proposed that the present cost-sharing requirements for flood damage prevention projects be modified to require a cash or in-kind contribution equal to 20 percent of the project first costs assigned to flood damage prevention. Application of this policy to the Town Brook project would require that non-Federal interests, make, in addition to the State contribution, a cash or in-kind contribution of an estimated $4,150,000 (20 percent of $20,750,000). The combined non-Federal share is currently estimated to be $5,188,000. I recommend construction authorization for Town Brook project in accordance with the President's proposed cost-sharing policy, provided that non-Federal interests will:

a. Provide without cost to the United States all lands, easements, and rights-of-way necessary for the construction and maintenance of the project. (The Federal Government will reimburse non-Federal interests for amounts in excess of 20 percent of project cost.)

b. Hold and save the United States free from damages due to construction of the works, except damages due to fault or negligence of the United States or its contractors.

c. Maintain and operate all works, including Braintree Dam and its appurtenant structures, after completion in accordance with regulations prescribed by the Secretary of the Army.

d. Provide without cost to the United States all alterations and replacements of existing utilities, and construct certain culverts and pavements.

e. Prescribe and enforce regulations to prevent encroachment on both the improvements and unimproved channels, and manage all project-related channels to preserve capacities for local drainage as well as for project functions.

f. Comply with the provisions under Section 210 and 305 of Public Law 91-646, 91st Congress, approved 2 January 1971 entitled "Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970."

29 Sep 80
DATE

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